Modification Notice - Regulation 22

Interest Holder	Santos QNT Pty Ltd	EMP Title	EP161 Beetaloo Basin Appraisal Pilot	Unique EMP ID No.	STO8-2	Change/ Mod No.	1	Date	21/08/2026
Brief Description	This modification updates the Chemical Risk Assessment (Appendix D) to incorporate additional chemicals identified following contractor engagement. The change affects only the composition of chemicals that may be used during drilling phase; existing controls to manage loss of containment remain in place and the revised assessment confirms that risks continue to be managed to ALARP and acceptable levels.								
Geospatial Files Included?	No								

Does the proposed change result in a new, or increased, potential or actual environmental impact or risk?	If an INCREASE in an existing potential or actual environmental impact or risk, is it provided for in the approved EMP?	Does the proposed change require additional mitigation measures to be included?	Has additional stakeholder engagement been conducted?	Does it require additional environmental performance standards and measurement criteria?	Does it affect compliance with Sacred Site Authority Certificates?	Does it affect current rehabilitation, weed, fire, wastewater, erosion and sediment control, spill or emergency response plans?	Will the environmental outcome continue to be achieved and will the impacts and risks be managed to ALARP and acceptable?
No	N/A	No	No	No	No	No. The only document affected is Appendix D (Chemical Risk Assessment).	Yes

Current EMP Text	Amended EMP Text
	There are no changes to the EMP text. The modification is an update to Chemical Risk Assessment (Appendix D), capturing additional chemicals that may be used during the drilling phase.

Data sensitivity - Internal

Data sensitivity - Internal

MEMO

To: [redacted]

From: [redacted]

CC: [redacted]

Date: August 18, 2026

Re: EP 161 – McArthur Appraisal Drilling and Cementing Fluid Modifications - Chemical Risk Assessment

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Introduction

Santos Ltd. ("Santos") is conducting an exploration and appraisal program within Exploration Permit (EP) 161, which is located in the Beetaloo Sub-basin of the broader McArthur Basin. The McArthur Basin is located southeast of Katherine, Northern Territory, and covers approximately 180,000 square kilometres. An overview of the project location is provided in **Figure 1**.

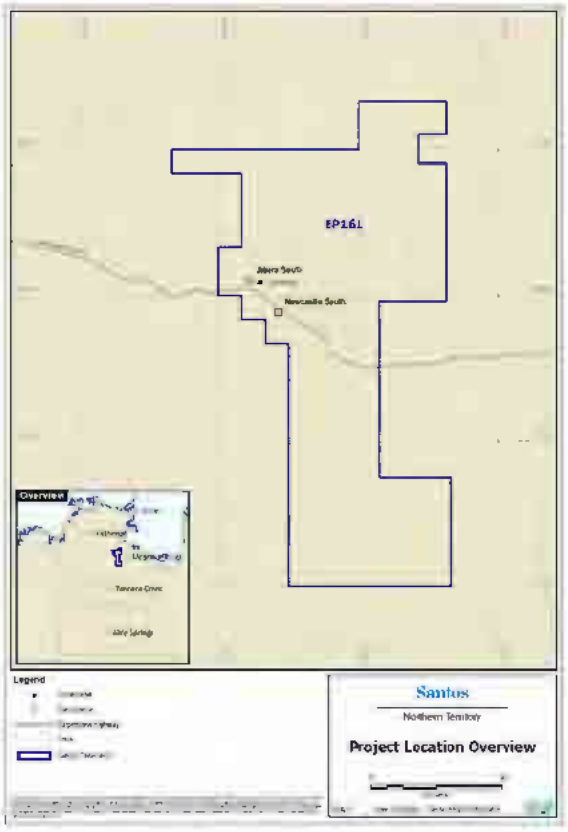


FIGURE 1 LOCATION OF NEW REGULATED ACTIVITIES

Since becoming the Operator of EP 161 in December 2012, Santos has:

- Acquired and processed 700 kilometres (km) of 2D seismic within EP 161 (including 193km during its recent 2024 campaign); and,
- Completed drilling the following wells: Tanumbirini 1 (2014), Marmbulligan 1 (2016), Tanumbirini 1, Tanumbirini 2HST1 and Tanumbirini 3HST1 (2019-2022).

Santos previously prepared an Environment Management Plan (EMP) for McArthur Basin 2019 – 2020 Hydraulic Fracturing Program in the Northern Territory EP 161. The EMP proposed Hydraulic Fracture Stimulation (HFS) to be conducted through 2019-2020 at the Tanumbirini 1, Tanumbirini 2H and Inacumba 1/1H well locations. Pursuant to the approval conditions of the EMP, a risk assessment of the hydraulic fracturing wastewater at the well locations is required.

As part of the EMP, a tiered chemical risk assessment (CRA) was completed in July 2019 for the flowback/produced water after hydraulic fracturing. This CRA evaluated the chemistry of the hydraulic fracturing fluid systems, estimated the probable concentration of these chemicals in flowback and completed a quantitative evaluation of risks. No unacceptable risks to human health and the environment were demonstrated (EHS Support, 2019).

A drilling fluid CRA was also completed in August 2021 to assess the use of an additional (contingency) chemical in the drilling fluid system. The additional chemical did not introduce a new environmental impact or environmental risk not provided for in the current plan for the activity (EHS Support, 2021).

Updates to the prior assessments were prepared by EHS Support in November 2025 (EHS Support, 2025a and 2025b) to evaluate proposed hydraulic fracturing fluids and tracer chemicals in future stimulation activities outlined in the EP 161 McArthur Appraisals EMP (Santos, 2025). The hydraulic fracturing fluid systems assessed in the CRA included chemicals proposed by Santos as part of their Coil Tubing Hydraulic Fracturing System (Coil Chemicals) and Standard Hydraulic Fracturing System (Hydraulic Fracturing Chemicals). In addition, the assessment also evaluated 11 new drilling fluid chemicals proposed for use in the installation of two new wells: one located at Jibera South and one at Newcastle South.

An additional drilling fluid CRA was completed in April 2026 to evaluate two additional new drilling fluid chemicals for the MMO mud system (EHS Support, 2026).

Santos has proposed modifications to the Baker Hughes and Halliburton drilling and cementing fluids for new well installations. Products associated with the proposed modifications are detailed in **Table 1**. One hundred and twenty-four (124) new chemicals have been identified in the modified system. Other chemicals in the proposed fluids have been previously assessed as part of prior CRAs completed for the EMP.

This technical memorandum assesses these proposed new 124 chemicals using a screening of potential human health and ecological hazards that should be considered for potential exposure to the drilling fluids and cuttings during transportation, drilling operations, and recycling and disposal of drilling mud and cuttings. This CRA is supported by a broader assessment of environmental conditions and risks and recommended avoidance, mitigation and management strategies which are outlined in the EMP for McArthur Basin (Santos, 2025). The current EMP includes regulated activities that were authorised by existing EMPs. This is to allow Santos to operate under a single, contemporary EMP and cease to operate under the existing EMPs.

Purpose and Approach

The purpose of this assessment was to determine if the additional chemicals introduce a new environmental impact or environmental risk not provided for in the current plan for the activity; or, an increase, not provided for in the current plan for the activity, in an existing environmental impact or environmental risk.

The assessment included the following components:

- Human health and environmental hazard assessment consistent with National Industrial Chemicals Notification and Assessment Scheme (NICNAS) assessment reports published as a result of the National Assessment of Chemicals Associated with Coal Seam Gas Extraction in Australia - https://www.dcceew.gov.au/water/coal-and-coal-seam-gas/national-assessment-chemicals/assessment-reports (CSG Guidance);
- Predicted No Effect Concentrations (PNECs) for water and soil derived to assess aquatic and terrestrial receptors, respectively
- Persistent, Bioaccumulative and Toxic (PBT) assessment

Conceptual Exposure Model

This CRA evaluates drilling and completion activities at well leases. For drilling activities utilising a water-based fluid system, a drilling fluid is created through the blending of manufacture-specific products and water at the surface and is used to lubricate the drill bit, maintain the stability of the borehole, facilitate the removal of drilling cuttings and maintain primary well control.

The lifecycle of chemicals used during the drilling and completion of wells includes the following general categories:

- Transportation of chemicals – from the supplier warehouse to the well lease and the transport of formulations between well leases
- Drilling and Completion Operations – storage, usage (e.g., blending, drilling, injecting) and subsequent recovery of fluids and chemicals at the well lease
- Recycling, disposal and beneficial reuse – recovered vendor and geogenic chemicals in drilling fluids

Without approved management controls in place (as per the WOMP), there is the potential for human and environmental receptors to be exposed to drilling fluid chemicals during drilling and completion operations and management of drilling fluids and cuttings. Based on an assessment of land use and an understanding of the project description in the McArthur Appraisals EMP (Santos, 2025), potential human and environmental receptors include:

1. Workers at the well lease involved with blending, storage, transfer, reuse, recovery and recycling of drilling fluids and cuttings; recycling, reuse or disposal of recovered materials including beneficial reuse activities such as land applications of drilling materials and dust suppression; and, mitigating releases at the well lease or along the transport or conveyance routes.
2. Agricultural workers or residents in irrigation areas.
3. Landholders that have access to the water supply from a bore hydraulically downgradient of the well lease.

4. Wildlife and livestock accessing the well lease and areas adjacent to a well lease, including surface water features, which have received runoff from an accidental release during drilling and completion operations.
5. Wildlife and livestock accessing areas of the well lease where materials have been applied as well as accessing stored materials in open structures, if present.
6. Aquatic flora and fauna within a proximal surface water body that has received runoff from an accidental release during drilling and completion operations or from beneficial reuse applications.
7. Wildlife including livestock that have access to the water supply from a bore hydraulically downgradient of the well lease.

In terms of risks associated with transport of chemicals and wastes, this risk is considered to be managed to a level as low as reasonably practicable. This is because the potential for a release is controlled through implementation of traffic management principles including use of designated trucking routes, vehicle signage, vehicle management systems (to manage speed and driving behaviour/habits) and, in the unlikely event of a vehicular accident, implementation of incident and spill response procedures. Given the highly regulated nature of transportation of chemicals (at both a Commonwealth and State level), transport-related scenarios are not evaluated further in this assessment. However, the outcome of the assessment should be used to inform emergency response actions.

Exposure of workers to drilling fluid chemicals is possible via inadvertent spills and leaks, during the recycling and beneficial reuse of recovered materials (e.g., drilling fluids and cuttings), and during application of the recovered material to land. However, chemical exposures to workers are controlled through engineering, management controls and personal protective equipment, which are focused on elimination and mitigation of the potential for dermal contact and potential for incidental ingestion. In addition, Safe Work Australia and Santos Occupational Safety Guidance are used to minimise human health exposure. As a result, no potentially complete exposure pathways were identified.

The management of chemicals and wastes will be conducted at the well lease using drums, totes and engineered tanks designed to contain the fluids. Avian receptors may have the potential for exposure to liquid in open top units. In the unlikely event of a release of drilling fluids to the ground, the potential for exposures (other than workers) is limited. The drilling and completion activities occur over a short duration and are conducted in controlled/operational areas, on a pre-prepared surface with engineered hard stand, within a perimeter fence which limits access to the public and precludes entry by livestock. Further, the activity level, noise, etc. will be a disincentive for wildlife and livestock to access the lease through gaps in the fencing or unsecured gates. If materials are spilled to the ground then investigation, remediation and rehabilitation activities will be implemented to address soil impacts.

The potential for a significant drilling fluid chemical loss to the formation during drilling is rare, particularly given the volumes used and the management controls in place during drilling. Where lost circulation is identified during drilling, a lost circulation fluid (i.e., cellulose) is used to plug the interval and prevent further loss of fluids. Despite the limited potential for large scale drilling fluid chemical losses during drilling, EHS Support (2015) completed modelling of how a conservative tracer or highly soluble organic constituents could migrate in the subsurface to assess the potential effects of potential loss of drilling muds on groundwater systems. The BIOSCREEN model was utilized to facilitate assessment of organic constituent mobility with and without biodecay. The modelling

indicated that the potential for impact on ground water quality is limited even under a worst-case scenario utilising conservative assumptions.

Exposure of potential receptors (other than workers) is also possible to residual chemicals in areas adjacent to a well lease that have been used for the application of materials for beneficial reuse. However, the EMP conditions regulate project reuse. A plan for the beneficial reuse of materials has been developed by a Suitably Qualified Person (SQP) in accordance with the EMP conditions which require materials of a certain quality and controls the maximum volumes that can be applied to land.

As a result, potential exposures during the drilling process are considered low due to the employment of mechanical equipment/processes, engineering controls (including secondary containment) and other mitigation and management strategies. Similarly, there is a low potential for human and environmental receptors exposed to residual chemicals in areas adjacent to a well lease that have been used for the application of materials for beneficial reuse and to surface water bodies that may receive runoff from beneficial reuse applications; due to EMP conditions regulating project reuse, minimum free board requirements, the remote nature of the well leases, vertical separation of groundwater and distances to watercourses, the ephemeral nature of the watercourses, and the physical and chemical properties of the residual chemicals post treatment or beneficial reuse. Finally, the probability of any surface related discharge infiltrating subsurface soils and migrating to groundwater is very low.

Findings

Table 2 presents the information compiled for the chemicals and the assessment results. Additional information is provided in the risk assessment dossiers (**Attachment A**) and the Safety Data Sheets (SDSs) (**Attachment B**).

The information for the new chemicals were then compared to the environmental fate properties (such as persistence, bioavailability and bioaccumulation), ecotoxicity and human health toxicity/hazards for the chemicals in the existing drilling and completion fluids. The existing drilling and completion fluids (refer **Table 3**) contains both low and high toxicity chemicals.

Based on this assessment, the additional new drilling chemicals exhibits similar or lesser PBT to the chemicals in the existing drilling chemicals. As such the additional chemicals do not introduce a new environmental impact or environmental risk not provided for in the current plan for the activity.

References

EHS Support. (2015). Santos GLNG Upstream Hydraulic Fracturing Risk Assessment Compendium of Assessed Fluid Systems. Revision 1. 23 November 2015.

EHS Support. (2019). Beetaloo McArthur Basin Hydraulic Fracturing Fluid System – Chemical Risk Assessment.

EHS Support. (2021). McArthur Basin New Drilling Fluid Chemical Risk Assessment. August 12, 2021.

EHS Support. (2025a). EP 161 – Beetaloo Basin Appraisal Pilot Hydraulic Fracturing Fluid System, Drilling Fluid and Cementing Chemicals - Chemical Risk Assessment. November 3, 2025.

EHS Support. (2025b). EP 161- McArthur Appraisal Tracer Chemicals – Chemical Risk Assessment. November 2, 2025.

EHS Support. (2026). EP 161 - McArthur Appraisal MMO Mud System – Chemical Risk Assessment. April 8, 2026.

Santos QNT Pty Ltd (Santos). (2019). Environment Management Plan: McArthur Basin 2019 Drilling Program NT Exploration Permit (EP) 161.

Santos. (2025). EP 161 McArthur Appraisal EMP.

Tables

Table 1
Proposed Drilling Fluid and Cementing Products
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Trade name	Supplier	Purpose
Cement- Class G + 35% SSA-1	Halliburton	Cement
Latex 4000	Halliburton	Cement Expanding Additive
MICROBOND HT Component	Halliburton	Cement Additive
Econolite Liquid	Halliburton	Cement Additive Stabiliser
Tuned Defense	Halliburton	Cement Spacer
Gascon 469	Halliburton	Cement Additive Stabiliser
Tuned Spacer III	Halliburton	Mud/Cement Spacer
SCR-100L	Halliburton	Cement Retarder
CFR-3L	Halliburton	Friction Reducer
BridgeMaker II LCM	Halliburton	Lost Circulation Control
D-AIR 3000L	Halliburton	Defoamer
SA-1015	Halliburton	Suspension Agent
Sodium Fluorescein Powder	Halliburton	Tracer
Calcium Chloride Liquid	Halliburton	Accelerator
SentinelCem Pro	Halliburton	Additive
Stabilizer 434D	Halliburton	Anionic Surfactant
ALL-TEMP	Baker Hughes	Deflocculant
Barite	Baker Hughes	Weighting Agent
Bentonite	Baker Hughes	Viscosifier
Bentonite Extender	Baker Hughes	Viscosifier
BIO-PAQ	Baker Hughes	Fluid Loss Control Agent
BRINE PAC 1500A	Baker Hughes	Corrosion Inhibitor
BRINE-PAC XTS	Baker Hughes	Corrosion Inhibitor
Calcium Chloride	Baker Hughes	Salt, weighting agent
Caustic Soda	Baker Hughes	pH Source
CF DESCO	Baker Hughes	Deflocculant
CHEK-LOSS	Baker Hughes	LCM
Citric Acid	Baker Hughes	pH Reducer
DFE-281	Baker Hughes	Wellbore Sealant
DFE-659	Baker Hughes	Lubricant
DFE-950	Baker Hughes	LCM
DRILLING STARCH	Baker Hughes	Fluid Loss Control Agent
DRISTEMP	Baker Hughes	HT Polymer
ECCO-TEMP	Baker Hughes	Temperature extender
FLOW-CARB	Baker Hughes	Bridging and Lost Circulation Material
FP-16L	Baker Hughes	Anti-foamer
KEM-SEAL	Baker Hughes	HT Fluid Loss Control Agent
KEM-SEAL PLUS	Baker Hughes	HT Fluid Loss Control Agent
LC-LUBE	Baker Hughes	Wellbore Strengthening
LC-LUBE Fine	Baker Hughes	Lost Circulation Material
LIME	Baker Hughes	pH Source, flocculant
Magnesium Oxide	Baker Hughes	pH Buffer
MAX GUARD E A	Baker Hughes	Shale Inhibitor
MAX-GUARD PLUS	Baker Hughes	Shale Inhibitor
MAX-GUARD PLUS A	Baker Hughes	Shale Inhibitor
MAX-SHIELD	Baker Hughes	Wellbore Nanosealant

Table 1
Proposed Drilling Fluid and Cementing Products
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Trade name	Supplier	Purpose
MIL-BAR	Baker Hughes	Weighting Agent
MIL-BIO SEA 98	Baker Hughes	Biocide
MIL-CARB series	Baker Hughes	Bridging Agent, LCM
MIL-GEL NT	Baker Hughes	Viscosifier
MIL-GARD XPR	Baker Hughes	Hydrogen Sulfide Scavenger
MIL-PAC LV	Baker Hughes	Fluid Loss Control Agent
MILSTARCH	Baker Hughes	Fluid Loss Control Agent
MIL-TEMP	Baker Hughes	Deflocculant
NANOSHIELD	Baker Hughes	Wellbore Nanosealant
NEW-DRILL LV	Baker Hughes	Encapsulator
NEW-DRILL PLUS	Baker Hughes	Encapsulator
NOXYGEN L	Baker Hughes	Oxygen Scavenger
NOXYGEN XT	Baker Hughes	Oxygen Scavenger
NUT PLUG 7808DF	Baker Hughes	Lost Circulation Material
NX LUBE DR PLUS	Baker Hughes	Lubricant
OMYADRILL All Grades	Baker Hughes	Bridging Agent, LCM
OMYACARB All Grades	Baker Hughes	Bridging Agent, LCM
OVA COL 110 HC	Baker Hughes	Shale Stabilizer
OVA COL 110 LC	Baker Hughes	Shale Stabilizer
OVA TRICIDE 70%	Baker Hughes	Biocide
Potassium Chloride	Baker Hughes	Shale Stabilizer
Potassium Hydroxide	Baker Hughes	pH Source
PREMIUM GEL NT	Baker Hughes	Viscosifier
PYRO-TROL II	Baker Hughes	HT Fluid Loss Control Agent
PYRO-VIS II	Baker Hughes	HT Viscosifier and Fluid Loss Control Agent
RADIAGREEN EME SALT	Baker Hughes	Lubricant
SAPP	Baker Hughes	Deflocculant
Soda Ash	Baker Hughes	Hardness Reducer
Sodium Bicarbonate	Baker Hughes	Cement Contamination Treatment
Sodium Chloride	Baker Hughes	Salt, Weighting Agent
TEQ-DEFOAM 1538	Baker Hughes	Defoamer
TEQ-LUBE 673	Baker Hughes	Lubricant
TEQ-SWEEP 962	Baker Hughes	Lost Circulation Material
Triethanolamine	Baker Hughes	Temperature extender
W.O.DEFOAM	Baker Hughes	Defoamer
XAN-PLEX D	Baker Hughes	Viscosifier
ZINC OXIDE	Baker Hughes	H2S Scavenger

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
1,2-Benzisothiazolin-3-one	2634-33-5	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* - 0.167 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - 0.097 mg/L Acute Aquatic - Algae and other aquatic plants -72-hr EC_{50} *Raphidocelis subcapitata* - 0.108 (geometric mean) Chronic Aquatic -72-hr NOEC *Raphidocelis subcapitata - 0.04 mg a.i./L* **Terrestrial Toxicity** BIT is slightly toxic to soil dwelling invertebrates and plants -14-day NOEC for *Eisenia fetida* (earthworms) - 234.5 mg a.i./kg dw -20-day NOEC for *Brassica oleracea var. capitata* [cabbage] - 30 mg a.i./kg dw -28-day NOEC for the inhibition of nitrogen transformation - 264 mg a.i./kg dw **$PNEC_{water}$** - 0.0004 mg/L **$PNEC_{soil}$** - 3 mg/kg soil dry weight (equilibrium partitioning method)	Qualitative Assessment: Human Health Hazard -Low to moderate concern. 1,2-Benzisothiazolin-3-one is moderately skin irritating, severely eye irritating and a skin sensitiser. It is a potential skin sensitiser. It has an oral LD_{50} between 670 and 1050 mg/kg bw. Limited systemic toxicity was observed. Ecological Hazard - Harmful to aquatic life with long lasting effects. Low concern to terrestrial organisms. PBT Assessment: Does meet the screening criteria for toxicity.	Environmental Fate Properties: Biodegradable at expected environmental concentrations PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Measured BCF of 6.62 L/kg in Lepomis macrochirus (bluegill sunfish) PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that 1,2-benzisothiazolin-3-one is not a PBT substance. Qualitative Assessment indicated human health hazard (e.g., potential skin sensitiser). This chemical is biodegradable and does not bioaccumulate. Additionally, the potential exposure to aquatic receptors is considered incomplete (refer to text). **Management:** Safe Work Australia and Santos Occupational Safety Guidance will be used to minimise human health exposure. Implementation of Constraints Protocol in EMP will be required to prevent accidental discharge/release.
1,2-Diaminocyclohexane	694-83-7	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Pimephales promelas* (Fathead minnow fish) - 1,825 mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - 76 mg/L Chronic Aquatic -96-hr NOEC *Pimephales promelas* (Fathead minnow fish) - 1,000 mg/L -21-day NOEC *Daphnia magna (* Water flea) - 10 mg/L -72-hr EC_{10} *Raphidocelis subcapitata* (Green algae)- 35 mg/L **Terrestrial Toxicity** -28-day LC_{50} *Eisenia foetida* (earthworms) - 250 mg/kg soil dw -28-day NOEC of 1,000 mg/kg dw for soil microorganisms **$PNEC_{water}$** -0.2 mg/L (chronic invertebrates) **$PNEC_{soil}$** -45 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Moderate concern. Corrosive to both the skin and eyes and caused weak skin sensitising effects. Moderate acute toxicity. Reproductive and systemic toxicant. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow of 0 L/Kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that 1,2-diaminocyclohexane is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., corrosive, systemic toxicant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
1,2-Ethanediamine, N-(2-aminoethyl)-	111-40-0	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Poecilia reticulata* (Guppy fish) - 430 mg/L Acute Aquatic - Invertebrates -48-hr EC_{50} Daphnia magna (Water Flea) - 32 mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Pseudokirchnerella subcapitata* (Green alga) - 1,164 mg/L Chronic Aquatic -28-day NOEC *Gasterosteus aculeatus* (Three-spined stickleback fish) - >10 mg/L -21-day NOEC *Daphnia magna (* Water flea) - 5.6 mg/L -72-hr NOEC *Pseudokirchnerella subcapitata (Green alga)* - 10 mg/L **Terrestrial Toxicity** -28-day LC_{50} *Eisenia foetida* (earthworms) - 250 mg/kg soil dw -28-day NOEC of 1,000 mg/kg dw for soil microorganisms **$PNEC_{water}$** -5.6 mg/L (chronic invertebrates) **$PNEC_{soil}$** -143 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Moderate concern. Necrotic to the skin and corrosive to the eye and potential skin sensitising effects. Moderate acute toxicity. Reproductive and systemic toxicant. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Measured BCF <0.3 L/Kg to 6.3 L/Kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that 1,2-Ethanediamine, N-(2-aminoethyl)- is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., necrotic, systemic toxicant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
1-Methoxy-2-propanol	107-98-2	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* (Rainbow trout fish) - >1,000 mg/L Acute Aquatic - Invertebrate -48-hr LC_{50} *Daphnia magna* - 23,300 mg/L Chronic Aquatic - Algae -7-day EC_{50} *Raphidocelis subcapitata* - 1,000 mg/L **Terrestrial Toxicity** No data available. **$PNEC_{water}$** - 1 mg/L (chronic algae) **$PNEC_{soil}$** - 0.013 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Low concern. 1-Methoxy-2-propanol is not an eye or skin irritant or a skin sensitiser. It has an low acute toxicity and no systemic toxicity is indicated. Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is 0.37 PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that 1-methoxy-2-propanol is not a PBT substance. Qualitative Assessment indicated it is not a concern to human health or the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
1-Propanesulfonic acid, 2-methyl-2-((1-oxo-2-propenyl)amino)-, monosodium salt, polymer with 2-propenamide	38193-60-1	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC50 *Lepomis macrochirus* - 1,000 mg/L Acute Aquatic - Invertebrate -48-hr EC50 *Daphnia magna* - 1,000 mg/L Acute Aquatic - Algae and other aquatic plants -96-hr NOEC *Pseudokirchneriella subcapitata* - 2,000 mg/L Chronic Aquatic No data available. **Terrestrial Toxicity** No data available. **$PNEC_{water}$** - 10 mg/L **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is -4.34 No bioconcentration studies PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** NICNAS has assessed the substance in an IMAP Tier 1 assessment and considers it a polymer of low concern. **PBT Assessment:** The overall conclusion is that 1-propanesulfonic acid, 2-methyl-2-((1-oxo-2-propenyl)amino)-, monosodium salt, polymer with 2-propenamide is not a PBT substance. Qualitative assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
2,4,6 Tridimethylaminomethyl phenol	90-72-2	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Cyprinus carpios* - >100 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - >100 mg/L Acute Aquatic - Algae and other aquatic plants -72-hr EC_{50} *Raphidocelis subcapitata* - 46.7 mg/L Chronic Aquatic - Algae Highly soluble in water, long-term testing for fish and invertebrates not required -72-hr NOEC *Raphidocelis subcapitata - 25.1 mg/L* **Terrestrial Toxicity** -No studies available. **$PNEC_{water}$** - Not derived **$PNEC_{soil}$** -Not derived	Qualitative Assessment: Human Health Hazard - Skin and eye irritant. The oral LD_{50} is >5,000 mg/kg. No systemic toxicity. Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow of -0.66 PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that 2,4,6 tridimethylaminomethyl phenol is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., skin and eye irritant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Safety Guidance will be used to minimise human health exposure.
2-Methoxy-1-propanol	1589-47-5	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Pimephales promelas* (Fathead minnow) - 4,998 - 183,537 mg/L Acute Aquatic - Invertebrate -48-hr LC_{50} *Daphnia magna* - 19,000 mg/L Chronic Aquatic - Algae -96-hr EC_{50} *Raphidocelis subcapitata* - 7,153 mg/L **Terrestrial Toxicity** -14-day LC_{50} in earthworms - 3,242 mg/kg dw (predicted) **$PNEC_{water}$** - 7.2 mg/L (chronic algae) **$PNEC_{soil}$** - 0.1 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Low concern. 2-Methoxy-1-propanol is slightly irritating to skin and eyes. It is a developmental toxicant. Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable (based on read-across) PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is -0.49 PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that 2-methoxy-1-propanol is not a PBT substance. Qualitative Assessment indicated human health hazard (e.g., irritant, developmental toxicant). it is not a concern to the environment. **Management:** Safe Work Australia and Santos Occupational Safety Guidance will be used to minimise human health exposure.
2-Methyl-4-isothiazolin-3-one	2682-20-4	**Aquatic Toxicity** *Based on data for mixture of 5-chloro-2-methyl-4-isothiazolin-3-one (CMI) and 2-methyl-4-isothiazolin-3-one (MI)* Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* - 0.19 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - 0.16 mg/L Acute Aquatic - Algae and other aquatic plants -72-hr EC_{50} *Selenastrum capricornutum* - 0.0063 mg/L Chronic Aquatic -38 day NOEC *Oncorhynchus mykiss* - 0.02 mg/L - 21 day NOEC Daphnia magna - 0.10 mg/L -72-hr NOEC *Selenastrum capricornutum - 0.0014 mg/L* **Terrestrial Toxicity** -14-day NOEC for *Eisenia fetida* (earthworms) - >143 mg a.i./kg dw -21-day NOEC for T*rifolium pratense, Oryza sativa and Brassica napu* s- >1000 mg/kg-soil dw -28-day NOEC for the inhibition of nitrogen transformation - 10 mg/kg soil day -8-day LC50 for mallard duck - 945 mg/kg -8-day LC50 for bobwhite quail - 3532 mg/kg **$PNEC_{water}$** - 0.00014 mg/L **$PNEC_{soil}$** - 0.02 mg/kg dw	Qualitative Assessment: Human Health Hazard -CMI/MI [3:1] mixture is moderate to highly toxic by oral, dermal, and inhalation routes. CMI/MI [3:1] is corrosive to the skin and eyes. It is a skin sensitiser. No systemic toxicity. Ecological Hazard - Harmful to aquatic life with long lasting effects. Less toxic to terrestrial receptors. PBT Assessment: Does meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: -Measured BCF of 2.3 PBT Assessment: Does not meet the criteria for bioaccumulation.	**PBT Assessment -** The overall conclusion is that 2-methyl-4-isothiazolin-3-one is not a PBT substance. Qualitative Assessment indicated human health hazard (e.g., potential skin sensitiser). This chemical is biodegradable and does not bioaccumulate. Additionally, the potential exposure to aquatic receptors is considered incomplete (refer to text). **Management:** Safe Work Australia and Santos Occupational Safety Guidance will be used to minimise human health exposure. Implementation of Constraints Protocol in EMP will be required to prevent accidental discharge/release.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
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Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
2-Methylbut-3-yn-2-ol	115-19-5	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} Leuciscus idus (Ide)- 3,400 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 500* mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Desmodesmus subspicatus* - 500 mg/L Chronic Aquatic -No studies available. **Terrestrial Toxicity** -No studies available. **$PNEC_{water}$** - 0.5 mg/L (acute invertebrate and algae) **$PNEC_{soil}$** -0.0276 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Low concern. Eye irritant. Moderate acute toxicity. Low systemic toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the criteria for persistence.	Environmental Fate Properties: Measured log Kow of 0.318 L/Kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that 2-Methylbut-3-yn-2-ol is not a PBT substance. Qualitative assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
2-Methylpropan-2-ol	75-65-0	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Pimephales promelas* (Fathead minnow fish) - >961 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} Daphnia magna (Water Flea) - 933 mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - >976 mg/L Chronic Aquatic -5-day NOEC *Clarias Gariepinus* (African catfish) - 332 mg/L -21-day NOEC *Daphnia magna (* Water flea) - 100 mg/L -96-hr NOEC *Raphidocelis subcapitata* (Green algae)- 976 mg/L **Terrestrial Toxicity** -14-day LC_{50} *Eisenia foetida* (earthworms) - 1,000 mg/kg soil dw **$PNEC_{water}$** -10 mg/L (chronic invertebrates) **$PNEC_{soil}$** -4.93 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Moderate concern. Eye irritant. Low acute toxicity. Systemic toxicant. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Inherently biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Measured log Kow of 0.32 L/Kg and a BCF of <5 L/Kg in carp PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that 2-Methylpropan-2-olis not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., eye irritant, systemic toxicant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
2-Naphthalenesulfonic acid, polymer with formaldehyde, sodium salt	36290-04-7	**Aquatic Toxicity** *Based on read-across* Acute Aquatic - Fish -96-hr LC_{50} - 105,000 mg/L (QSAR) Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - 49,421 mg/L (QSAR) Acute Aquatic - Algae and other aquatic plants -72-hr EC_{50} *Pseudokirchnerella subcapitata* - 4,768 mg/L (QSAR) **Terrestrial Toxicity** -No data available. **$PNEC_{water}$** -Not derived **$PNEC_{soil}$** - Not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the criteria for persistence.	Environmental Fate Properties: Log Kow <1 (group members) PBT Assessment: Does not meet criteria for bioaccumulation	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that 2-naphthalenesulfonic acid, polymer with formaldehyde, sodium salt is not a PBT substance Qualitative assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
2-Propenenitrile, polymer with 1,3-butadiene	9003-18-3	**Aquatic Toxicity** -No studies are available. -Expected to be low concern for toxicity to aquatic organisms. High molecular weight anionic polymers (including water-soluble polyanions) generally have low toxicity to fish and aquatic invertebrates. These polymers cannot be absorbed across biological membranes in aquatic organisms, and therefore toxicity only occurs through indirect effects such as chelation of essential nutrients. **Terrestrial Toxicity** No studies available. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the criteria for persistence.	Environmental Fate Properties: Not expected to bioaccumulate because of its high molecular weight. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** NICNAS has assessed 2-propenenitrile, polymer with 1,3-butadiene in an IMAP Tier 1 assessment and considers it a polymer of low concern. **PBT Assessment:** The overall conclusion is that 2-propenenitrile, polymer with 1,3-butadiene is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
2-Propenoic acid, polymer with 1,3-butadiene and ethenylbenzene	25085-39-6	**Aquatic Toxicity** -No studies are available. -Expected to be low concern for toxicity to aquatic organisms. High molecular weight anionic polymers (including water-soluble polyanions) generally have low toxicity to fish and aquatic invertebrates. These polymers cannot be absorbed across biological membranes in aquatic organisms, and therefore toxicity only occurs through indirect effects such as chelation of essential nutrients. **Terrestrial Toxicity** No studies available. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Internationally, USEPA has assessed 2-propenoic acid polymer, with 1,3-butadiene and ethenylbenzene and considers it a low-risk polymer Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the criteria for persistence.	Environmental Fate Properties: Not expected to bioaccumulate because of its high molecular weight. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that 2-propenoic acid, polymer with 1,3-butadiene and ethenylbenzene is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
2-Propenoic acid, sodium salt (1:1)	107097-75-6	**Aquatic Toxicity** -No studies are available. -Expected to be low concern for toxicity to aquatic organisms. Due to poor solubility and high molecular weight not expected to be bioavailable. Does not contain any reactive functional groups. **Terrestrial Toxicity** No studies available. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the criteria for persistence.	Environmental Fate Properties: Not expected to bioaccumulate because of poor water solubility and high molecular weight PBT Assessment: Does not meet criteria for bioaccumulation	**PBT Assessment:** The overall conclusion is that 2-Propenoic acid, sodium salt (1:1) is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
3, 3'-Methylene bis (5-methyl oxazolidine)	66204-44-2	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr *Danio rerio* (Zebrafish) - 57.7 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - 29 mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Desmodesmus subspicatus* - 5.7 mg/L Chronic Aquatic - 21 day NOEC Daphnia magna - 1.3 mg/L -72-hr NOEC *Desmodesmus subspicatus* - 2.2 mg/L **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - 0.026 mg/L (chronic invertebrates) **$PNEC_{soil}$** -0.00035 mg/L (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Corrosive to the skin and eyes. It is also a skin sensitiser. It has an oral LD_{50} of 630 mg/kg. No system toxicity relevant to humans has been observed. Ecological Hazard - Moderate concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the criteria for persistence.	Environmental Fate Properties: Estimated BCF in fish of 1.41 L/Kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that 3, 3'-methylene bis (5-methyl oxazolidine) is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., corrosive, skin sensitiser). It is a moderate concern to the environment. **Management:** Implementation of Constraints Protocol in EMP will be required to prevent accidental discharge/release. Safe Work Australia and Santos Occupational Safety Guidance will be used to minimise human health exposure.
3,6-Diazaoctanethylenediamin	112-24-3	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oryzias latipes* (Japanese rice fish) - >100mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} Daphnia magna (Water Flea) - 43.1 mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - 30.854 mg/L Chronic Aquatic -21-day EC_{10} *Daphnia magna (* Water flea) - 1.75 mg/L -72-hr EC_{10} *Raphidocelis subcapitata* (Green algae)- 2.385 mg/L **Terrestrial Toxicity** -No studies available. **$PNEC_{water}$** -0.0175 mg/L (chronic invertebrates) **$PNEC_{soil}$** -0.7476 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Moderate concern. Causes necrosis and severely irritates the eye. Is a skin sensitiser. Systemic toxicant. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the criteria for persistence.	Environmental Fate Properties: Measured BCF of <5 L/Kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that 3,6-Diazaoctanethylenediamin is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., eye irritant, systemic toxicant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
5-Chloro-2-methyl-3(2H)-isothiazolone mixture with 2-methyl-3(2H)-isothiazolone	55965-84-9	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* - 0.19 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - 0.16 mg/L Acute Aquatic - Algae and other aquatic plants -72-hr EC_{50} *Selenastrum capricornutum* - 0.0063 mg/L Chronic Aquatic -38 day NOEC *Oncorhynchus mykiss* - 0.02 mg/L - 21 day NOEC Daphnia magna - 0.10 mg/L -72-hr NOEC *Selenastrum capricornutum - 0.0014 mg/L* **Terrestrial Toxicity** -14-day NOEC for *Eisenia fetida* (earthworms) - >143 mg a.i./kg dw -21-day NOEC for *Trifolium pratense, Oryza sativa and Brassica napus* - >1000 mg/kg-soil dw -28-day NOEC for the inhibition of nitrogen transformation - 10 mg/kg soil day -8-day LC50 for mallard duck - 945 mg/kg -8-day LC50 for bobwhite quail - 3532 mg/kg **$PNEC_{water}$** - 0.00014 mg/L **$PNEC_{soil}$** - 0.02 mg/kg dw	Qualitative Assessment: Human Health Hazard -CMI/MI [3:1] mixture is moderate to highly toxic by oral, dermal, and inhalation routes. CMI/MI [3:1] is corrosive to the skin and eyes. It is a skin sensitiser. No systemic toxicity. Ecological Hazard - Mixture of CMI and MI exhibits significant acute and chronic aquatic toxicity. Less toxic to terrestrial receptors. PBT Assessment: Does meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: -Measured BCF of 2.3 PBT Assessment: Does not meet the criteria for bioaccumulation.	**PBT Assessment -** The overall conclusion is that 5-chloro-2-methyl-3(2H)-isothiazolone mixture with 2-methyl-3(2H)-isothiazolone is not a PBT substance. Qualitative Assessment indicated human health hazard (e.g., potential skin sensitiser). This chemical is biodegradable and does not bioaccumulate. Additionally, the potential exposure to aquatic receptors is considered incomplete (refer to text). **Management:** Safe Work Australia and Santos Occupational Safety Guidance will be used to minimise human health exposure. Implementation of Constraints Protocol in EMP will be required to prevent accidental discharge/release.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
9-Octadecenamide, n,n-bis-2(hydroxy-ethyl)-,(Z)	93-83-4	**Aquatic Toxicity** Acute Aquatic -96-hr LC_{50} *Danio rerio* - 5.1 mg/L -48-hr EC_{50} *Daphnia magna* - 3.2 mg/L -72-hr EC_{50} *Desmodesmus subspicatus* - 18.6 mg/L Chronic Aquatic -28-day NOEC to *Oncorhynchus mykiss* 0.26 mg/L [measured] -21-d NOEC in a Daphnia 0.07 mg/L [measured] -72-hr EC10 to *Desmodesmus subspicatus* 1.4 mg/L **Terrestrial Toxicity** -No experimental studies are available. **$PNEC_{water}$** - 0.007 mg/L (acute invertebrate) **$PNEC_{soil}$** - 0.16 (equilibrium partitioning method)	Qualitative Assessment: Human Health Hazard - Expected to be a skin and eye irritant; not a skin sensitiser; low concern for systemic toxicity. Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Estimated BCF of 112.53 L/Kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that 9-octadecenamide, n,n-bis-2(hydroxy-ethyl)-,(Z) is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., skin and eye irritant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
9-Octadecenoic acid (9Z)-, monoester with 1,2,3-propanetriol	25496-72-4	**Aquatic Toxicity** -No data is available. Aquatic toxicity is unlikely to occur as the substance is highly insoluble (solubility: 0.000009738 g/L at 25° C) in water **Terrestrial Toxicity** -No data is available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern based on read-across. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Hazard Assessment: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Estimated BCF of 2,006 L/Kg whole body ww, based on read-across. However, this value is likely to be overestimated. PBT Assessment: Does meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that 9-octadecenoic acid (9Z)-, monoester with 1,2,3-propanetriol is not a PBT substance. Qualitative Assessment indicated a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Acrylamide	79-06-1	**Aquatic Toxicity** Acute Aquatic - Fish -LC_{50} Rainbow Trout, *Onchorhyncus mykiss* , 180 mg/L Acute Aquatic - Invertebrate -48 hour EC50 - *Daphnia Magna* - 60 mg/L Acute Aquatic - Algae -72 hour EC50 - *Pseudokirchneriella subcapitata* - 33 mg/L Chronic Aquatic - Fish -28 day - NOEC *Cyprinus carpio* - 5 mg/L **Terrestrial Toxicity** No data available **$PNEC_{water}$** - 0.05 mg/L **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: log Kow of -0.67 PBT Assessment: Does not meet the screening criteria for bioaccumulation	**PBT Assessment:** The overall conclusion is that acrylamide is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied..
Alcohol ethoxy sulfate, sodium salt	68585-34-2	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Danio rerio* - 25 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 86 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Pseudokirchneriella subcapitata* - 115 mg/L Chronic Aquatic -28-day NOEC fish - 37 mg/L (QSAR) -21-day NOEC invertebrates- 20 mg/L (QSAR) **Terrestrial Toxicity** -14-day NOEC for *Eisenia fetida* (earthworms) - 2,600 mg/kg soil dw -72-hr EC50 in plants (*Lactuca sative*) - 143 mg/kg-soil dw **$PNEC_{water}$** - 0.65 ug/L (ANZG for alcohol ethoxysulfates) **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Irritant to skin and eyes in neat form. It is not a skin sensitiser. Low acute toxicity. It has low repeat dose toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Hazard Assessment: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is -2.03 PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that alcohol ethoxy sulfate, sodium salt is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., slightly irritating). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Alcohols, C16-18, ethoxylated propoxylated	68002-96-0	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC50 *Danio rerio* - 1-10 mg/L Acute Aquatic - Invertebrate -48-hr EC50 Daphnia Magna - 1.45-1.79 mg/L Acute Aquatic - Algae and other plants -72-hr EC50 *Desmodesmus subspicatus* - 2.58-3.44 mg/L Chronic Aquatic -72-hr NOEC *Selenastrum capricornutum* - 1.7 mg/L **Terrestrial Toxicity** -No studies are available. Risk is negligible. **$PNEC_{water}$** - 0.14 mg/L (ANZG DGV) **$PNEC_{soil}$** -0.019 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Low concern. Irritant to skin and eyes. It is not a skin sensitiser. Low acute toxicity. No systemic effects have been observed. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Hazard Assessment: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is 7.92. However, the estimated BCF is 1,187 L/Kg. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that alcohols, C16-18, ethoxylated propoxylated is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., skin and eye irritant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Alcohols, C6-10, ethoxylated	70879-83-3	**Aquatic Toxicity** In developing a water quality guideline for alcohol ethoxylates (AEs), the toxicity data was normalised for a specific alkyl chain length or a specific number of ethylene oxide (EO) groups. The NOECs listed below were normalised to an alkyl chain length of C13.3 and EO of 8.2. There were chronic data for 13 species that belonged to 7 taxonomic groups (fish, crustacea, blue alga, diatoms, green alga, protozoa, and worms). Freshwater fish: 2 species, 720 to 1,500 µg/L. Freshwater crustaceans: 2 species, 590 to 860 µg/L. Freshwater rotifers: 1 species, Brachionus calyciflorus, 1,300 µg/L. Freshwater algae, diatoms and blue-green algae: 6 species, 200 to 8,700 µg/L. Freshwater mesocosms: 4 NOEC data for multiple species tests were 80, 80, 320 and 330 µg/L, although replication was insufficient to meet OECD (1992) requirements. Normalised data were 380, 380, 320 and 1,520 µg/L. **Terrestrial Toxicity** -NOEC values for soil invertebrates of 220 mg/kg and 1,000 mg/kg **$PNEC_{water}$** - 0.14 mg/L (ANZG DGV) **$PNEC_{soil}$** -7.32 mg/kg dw	Qualitative Assessment: Human Health Hazard - Low concern. Irritant to eyes. It is not a skin sensitiser. Low acute toxicity. No systemic effects have been observed. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Hazard Assessment: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Measured BCFs < 387 PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that alcohols, C6-10, ethoxylated is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., eye irritant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Aluminium	7429-90-5	**Aquatic Toxicity** In developing a water quality guideline for aluminium (ANZG, 2018), ANZG separated the screened freshwater toxicity data into those conducted at pH >6.5 and those at pH <6.5. These data are summarised below Freshwater pH >6.5 -Fish: The 48-96 hour LC50 values for 5 species were 600 to 106,000 µg/L (the lowest value was for Salmo salar). The chronic 8- to 28-day NOEC equivalents from seven species were 34-7,100 µg/L. The lowest measured chronic value was an 8-day LC50 for Micropterus species of 170 µg/L. -Amphibian: The 96-hour LC50 values for Bufo americanus were 860-1,660 µg/L. The chronic 8-day LC50 for Bufo americanus was 2,280 µg/L. -Crustacean: The 48-hour LC50 values for one species were 2,300-36,900 µg/L. The chronic 7- to 28-day NOECs were 136-1,720 µg/L. -Algae: The 96-hour EC50 values were 460-570 µg/L based on population growth. The NOECs for two species were 800-2,000 µg/L. Freshwater pH<6.5 (all between pH 4.5 and 6.0) -Fish: The 24-96-hour LC50 values for two species were 15-4,200 µg/L (the lowest value was for Salmo trutta). The 21- to 42-day LC50 values were 15-105 µg/L. -Amphibian: The 96- to 120-day LC50 values were 540-2,670 µg/L; the absolute range was 400-5,200 µg/L. -Algae: The NOEC from one species was 2,000 µg/L based on growth. **Terrestrial Toxicity** -Negligible terrestrial toxicity (ECHA) **$PNEC_{water}$** - 0.055 mg/L (ANZG DGV PH>6.5); 0.008 mg/L (ANZG DGV PH<6.5) **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Aluminium is corrosive to the skin and eyes. It is not a skin sensitiser. It has an oral LD_{50} >2,000 mg/kg. Systemic effects associated with neurotoxicity have been identified from repeated dose toxicity studies. Ecological Hazard - Moderate Concern. Available data indicate that dissolved aluminium while toxic under acidic conditions, are relatively non-toxic in most waters with circumneutral pH. Factors that influence aluminium toxicity are consistent with the factors that influence aluminium speciation. These factors include pH, dissolved organic carbon (DOC), and water hardness. PBT Assessment: Does meet the screening criteria for toxicity.	Environmental Fate Properties: Biodegradation is not applicable to inorganic substances. PBT Assessment: Not applicable.	Environmental Fate Properties: Based on the data available, aluminum is considered to have a low bioaccumulation potential to aquatic organisms under circum neutral conditions PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that aluminium is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., corrosive to the skin and eyes). This chemical has a low potential for bioaccumulation. Available data indicate that aluminium compounds are relatively non-toxic in most waters with circumneutral pH. Additionally, the potential exposure to aquatic receptors is considered incomplete (refer to text). **Management:** Safe Work Australia and Santos Occupational Safety Guidance will be used to minimise human health exposure. Implementation of Constraints Protocol in EMP will be required to prevent accidental discharge/release.
Aluminium oxide	1344-28-1	**Aquatic Toxicity** Data available on aluminium oxide have been generated to demonstrate bioavailability of aluminium in acid water. Adequate studies were found to evaluate the intrinsic toxicity of aluminium oxide. Nonetheless, aluminium oxide is not expected to pose a substantial acute toxicity concern to aquatic receptors **Terrestrial Toxicity** -No data available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Chemically and biologically inert Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Substance is an inorganic mineral. PBT Assessment: Not applicable	Environmental Fate Properties: Aluminium oxide is a naturally inorganic substance and as an inorganic complex is not expected to bioaccumulate. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that aluminium oxide is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Aluminium stearate	637-12-7	**Aquatic Toxicity** -No studies available. Aluminium stearate is highly insoluble in water (solubility of <0 g/L). Thus, it is expected to have low acute and chronic toxicity to aquatic organisms. **Terrestrial Toxicity** -No studies available. Aluminium stearate is not persistent in soil. The exposure risk to soil dwelling organisms is moderate to low. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: estimated BCF of 3.162 L/kg and experimental BCF range of 2.2 to 813 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that aluminium stearate is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
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Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Ammonium chloride	12125-02-9	**Aquatic Toxicity** Acute toxicity - Fish -Ranbow trout - 42.91 mg/L ammonium chloride, -Mountain whitefish (Prosopium williamsoni): LC50 (96h) 46.27 mg/L for ammonium chloride; Acute toxicity - Invertebrates - *Daphnia magna* 136.6 mg/L - EC_{20} *Daphnia magna* 47 mg/L Acute - Algae -EC_{50} *Chlorella vulgaris* 1300 mg/L Chronic toxicity - Fish -*Lepomis macrochirus* EC20 = 4.28 mg/L ammonium chloride. **Terrestrial Toxicity** No data available **$PNEC_{water}$** - 0.25 mg/L **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - low concern Ecological Hazard - low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties - Substance is inorganic, dissociates completely. PBT Assessment: Not applicable	Environmental Fate Properties: Not expected to bioaccumulate because inorganic PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that ammonium chloride is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Ammonium hydrogensulphite	10192-30-0	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Leuciscus idus (Ide)* - 159.7 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - >100* mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitatas* - >84 mg/L Chronic Aquatic -35-day NOEC *Danio rerio* (zebra fish) - >10.5 mg/L -21-day NOEC *Daphnia magna* (water flea) - >8.41 mg/L -72-hr NOEC *Raphidocelis subcapitatas* - >84.1 mg/L **Terrestrial Toxicity** -No studies available. **$PNEC_{water}$** - 0.841 mg/L (chronic invertebrate) **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern. Low acute toxicity. Moderate systemic toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: an inorganic salt that dissociates to its respective cations and anions in aqueous solutions. Biodegradation is not applicable to these inorganic ions. PBT Assessment: Not applicable	Environmental Fate Properties: dissociates into sulphite anions and the respective ammonium cations in aqueous solution, ions that are ubiquitous in the environment and essential to all living organisms (flora and fauna). PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that ammonium hydrogensulphite is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., systemic toxicant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Ammonium hydroxide	1336-21-6	**Aquatic Toxicity** Following acute and chronic toxicity data utilised by ANZG to develop a high reliability default guideline value for ammonia Freshwater fish 24 – 96 hour LC50 values for 15 species were 3,944 to 169,873 ug/L 6- to 28-d chronic NOEC and EC20 (growth and survival) for 9 species were 1,350 to 19,720 ug/L. Freshwater crustacean 24 – 96 hour LC50 values for 10 species are 7,754 to 108,500 ug/L. 7-day to 10-week chronic NOEC and EC20 values (reproduction) for 4 species are 1,450 to 19,770 ug/L. Freshwater insects 24 – 96 hour LC50 values for eight species are 15,091 to 282,400 ug/L. 29-day chronic NOEC (reproduction) for two species are 1,790 to 4,400 ug/L. Freshwater molluscs Acute toxicity for seven species were 12,588 to 74,623 ug/L. Chronic 42- to 60-day NOEC and EC20 (reproduction and survival) for two species are 540 to 2,620 ug/L. Freshwater annelid 24 – 96 hour LC50 values for two species are 20,071 to 79,788 ug/L. Freshwater rotifer 24-hour LC50 for Brachionus rubens is 1,300 ug/L. Freshwater Platyhelminthes 24 – 96 LC50 value for Polycelus tenuis is 37,634 ug/L. **Terrestrial Toxicity** -Moderately toxic **$PNEC_{water}$** - 0.9 mg/L (ANZG DGV at pH 8) **$PNEC_{soil}$** - -not derived	Qualitative Assessment: Human Health Hazard - Depending on the concentration, solutions of ammonia are corrosive, irritating or non-irritating. These solutions cause direct effects to the skin, eyes, respiratory tract and gastrointestinal tract. No systemic toxicity. Ecological Hazard - Moderately toxic PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Ammonium hydroxide is a solution of ammonia in water. Ammonia is part of the nitrogen cycle. Biodegradation is not applicable to ammonia or the ammonium ion. PBT Assessment: Not applicable	Environmental Fate Properties: Ammonia is not expected to bioaccumulate in the environment because of its dissociation to the ammonium ion and because it is part of the nitrogen cycles in air, soil and water. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework. It is a reactive substance which rapidly converts into species of low ecotoxicological concern. **PBT Assessment:** The overall conclusion is that ammonium hydroxide is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., irritant). It is a moderate concern to the environment. **Management:** Implementation of Constraints Protocol in EMP will be required to prevent accidental discharge/release. Safe Work Australia and Santos Occupational Safety Guidance will be used to minimise human health exposure.

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Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Ammonium sulfate	7783-20-2	**Aquatic Toxicity** Acute Aquatic - Fish -96-hour *Onchorhyncus mykiss, Salmo gairdneri* - LC50 - 53 mg/L -96-hour *Prosopium williamsoni* - LC50 - 57.2 mg/L Acute Aquatic - Invertebrate -48-hr EC50 *Daphnia magna* - 169 mg/L -48-hr EC50 *Ceriodaphnia acanthina* - 121.7 mg/L Chronic Aquatic - Fish -30-day *Lepomis macrochirus* - EC10 5.29 mg/L Chronic Aquatic - Invertebrate -10-week EC10 *Hyallella azteca* - 3.12 mg/L Chronic Aquatic - Algae -18-day EC50 - *Chlorella vulgaris* - 2,700 mg/L -5-day EC50 - *Chlorella vulgaris* - 1,605 mg/L **Terrestrial Toxicity** No data were available **$PNEC_{water}$** - 0.312 mg/L **PNEC** - not derived	Qualitative Assessment: Human Health Hazard - low concern Ecological Hazard - low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Dissociates completely in aqueous media PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is -5.1 PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that ammonium sulfate is not a PBT substance. Qualitative assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Ascorbic acid	50-81-7	**Aquatic Toxicity** -Limited aquatic toxicity data is available for ascorbic acid. Low toxicity of ascorbic acid would be expected since it is naturally present in many organisms and is an essential vitamin for many species. **Terrestrial Toxicity** -In feeding studies with chickens, no adverse effects were seen at a concentration of 3.3 g/kg diet. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Experimental Log Kow of -1.85 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that ascorbic acid is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Benzenemethanol	100-51-6	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oryzias latipes* (Japanese rice fish) - >100 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 55* mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - 759 mg/L Chronic Aquatic -21-day NOEC Daphnia magna - 51 mg/L 72-hr NOEC *Raphidocelis subcapitata* - 556 mg/L - **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - 1.02 mg/L (chronic invertebrates) **$PNEC_{soil}$** -0.21 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Low Concern. Benzenemethanol is slightly irritating to skin and eyes. It is not a skin sensitiser. It has moderate acute toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is 1.05 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS/AICIS:** AICIS has evaluated this chemical and determined it is a chemical which is unlikely to require further regulation to manage risks to environment. **PBT Assessment:** The overall conclusion is that benzenemethanol is not a PBT substance. Qualitative Assessment indicated a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied..
Bisphenol A / Epichlorohydrin resin	25068-38-6	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oryzias latipes* (Japanese rice fish) - 1.41 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 1.4* mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - 9.4 mg/L Chronic Aquatic -21-day NOEC Daphnia magna - 0.3 mg/L 72-hr NOEC *Scenedesmus capricornutum* - 4.2 mg/L - **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - 0.006 mg/L (chronic algae) **$PNEC_{soil}$** -0.0015 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Low concern. Skin sensitiser. Low acute and oral repeat dose toxicity. Ecological Hazard - Moderate Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is 3.6 L/Kg with a BCF range 0.56 - 31 L/Kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that bisphenol A/epichlorohydrin resin is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., slightly irritating). It is a moderate concern to the environment. **Management:** Implementation of Constraints Protocol in EMP will be required to prevent accidental discharge/release. Safe Work Australia and Santos Occupational Safety Guidance will be used to minimise human health exposure.

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Boric acid	10043-35-3	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} Fathead minnow - 79.7 mg/L Acute Aquatic - Invertebrate -96-hr LC_{50} *Legumia recta* (Black sandshell mussel) - 147 mg/L -96-hr LC_{50} *Hyalella azteca* -64 mg/L Acute Aquatic - Algae -72-hr EC_{50} *Pseudokirchneriella subcapitata* - 52.4 mg/L Chronic Aquatic - Fish -34-day NOEC (Biomass) *Danio rerio* - 1.8 mg B/L -32-day NOEC (Mortality) *Pimephales promelas* - 11 mg B/L Chronic Aquatic- Invertebrate -14-day NOEC (Reproduction) *Daphnia magna* - 2.4 mg B/L Chronic Aquatic - Algae -4-day NOEC (Growth) *Pseudokirchneriella subcapitata* -2.8 mg B/L **Terrestrial Toxicity** Boron toxicity will pose a risk to terrestrial plants when soil concentrations exceed 15 mg/kg of extractable boron **$PNEC_{water}$** - 0.94 mg/L (ANZG DGV for 95% species protection level) **$PNEC_{soil}$** -5.7 mg/kg dw (SSD method)	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Dissociates completely PBT Assessment: Not applicable for this inorganic compound	Environmental Fate Properties: -BCF <0.1-10.5 L/kg (reported for borates in fish and oysters). PBT Assessment: Does not meet the criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that Boric Acid is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Butanedioic acid, 2-sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (1:1)	2373-38-8	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* - 960 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - >100* mg/L Acute Aquatic - Algae and other plants -72-hr *Desmodesmus subspicatus* - >100 mg/L Chronic Aquatic -28-day NOEC *Pimephales promelas* - >14.8 mg/L -21-day EC_{10} Daphnia magna - >15 mg/L -72-hr EC_{10} Desmodesmus subspicatus - >100 mg/L **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - 0.18 mg/L (chronic invertebrate) read-across to group member **$PNEC_{soil}$** -2.29 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Low concern. Irritating to skin and severely irritating to the eyes. It is not a skin sensitiser. It has moderate acute oral toxicity. Repeat dose toxicity studies indicated systemic toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is 0 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that butanedioic acid, 2-sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (1:1) is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., eye and skin irritant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Butanedioic acid, 2-sulfo-, 1,4-bis(2-methylpropyl) ester, sodium salt (1:1)	127-39-9	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Danio rerio* - >900 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - >898.8* mg/L Acute Aquatic - Algae and other plants -72-hr *Desmodesmus subspicatus* - >899.1 mg/L Chronic Aquatic -21-day EC_{10} Daphnia magna - >14.2 mg/L -72-hr EC_{10} Desmodesmus subspicatus - >899.1 mg/L **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - 0.18 mg/L (chronic invertebrate) read-across to group member **$PNEC_{soil}$** -2.29 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Low concern. Irritating to skin and severely irritating to the eyes. It is not a skin sensitiser. It has moderate acute oral toxicity. Repeat dose toxicity studies indicated systemic toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is -3.326 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS/AICIS:** AICIS has evaluated this chemical and determined it is a chemical which is unlikely to require further regulation to manage risks to environment. **PBT Assessment:** The overall conclusion is that butanedioic acid, 2-sulfo-, 1,4-bis(2-methylpropyl) ester, sodium salt (1:1) is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., eye and skin irritant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt	577-11-7	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Danio rerio* - 49 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 15.2* mg/L Acute Aquatic - Algae and other plants -72-hr *Desmodesmus subspicatus* - 82.5 mg/L Chronic Aquatic -21-day EC_{10} Daphnia magna - 9 mg/L -72-hr EC_{10} Desmodesmus subspicatus - 22 mg/L **Terrestrial Toxicity** -56-day NOEC *Eisenia fetida* (earthworms) >104 mg/kg dw **$PNEC_{water}$** - 0.18 mg/L (chronic invertebrate) **$PNEC_{soil}$** -2.29 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Low concern. Irritating to skin and severely irritating to the eyes. It is not a skin sensitiser. It has moderate acute oral toxicity. Repeat dose toxicity studies indicated systemic toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is 1.998 L/kg. Measured BCF of 9.33 L/Kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., eye and skin irritant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.

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Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Butyl glycidyl ether	2426-08-6	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} Oncorhynchus mykiss - 65 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - 9.2 mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - 35 mg/L **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - 0.0092 mg/L (acute invertebrates) **$PNEC_{soil}$** -0.0061 mg/kg dw (equilibrium partitioning method)	Qualitative Assessment: Human Health Hazard - Low acute toxicity. Skin and respiratory irritant, and has the potential to cause serious eye damage. It is a skin sensitiser. Potential for suspected carcinogenicity. Reproductive toxicant. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is 0.63 L/Kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that butyl glycidyl ether is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., irritant, reproductive toxicant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Butylated hydroxytoluene	128-37-0	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oryzias latipes* (Japanese rice fish) - 1.1 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 0..48* mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - >0.24 mg/L Chronic Aquatic -30-day NOEC Oryzias latipes (Japanese rice fish) - 0.053 mg/L -21-day NOEC Daphnia magna - 0.069 mg/L -72-hr NOEC Raphidocelis subcapitata - 0.24 mg/L **Terrestrial Toxicity** -No relevant studies available **$PNEC_{water}$** - 0.0053 mg/L (chronic fish) **$PNEC_{soil}$** -0.56 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Moderate skin irritant and moderate skin sensitiser. Moderately acutely toxic. Reproductive and developmental toxicant. Ecological Hazard - Very toxic to aquatic life with long lasting effects PBT Assessment: Does meet the screening criteria for toxicity.	Environmental Fate Properties: Not expected to persist in the environment. PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is 5.1 L/kg PBT Assessment: Does meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that butylated hydoxytoluene is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., reproductive and developmental toxicant). This chemical does not persist in the environment. Additionally, the potential exposure to aquatic receptors is considered incomplete (refer to text). **Management**: Safe Work Australia and Santos Occupational Safety Guidance will be used to minimise human health exposure. Implementation of Constraints Protocol in EMP will be required to prevent accidental discharge/release.
C.I. Basic Violet 10 (Rhodamine B or D&C Red No 19)	81-88-9	**Aquatic Toxicity** Acute Aquatic - Fish -48-hr LC_{50} *Oryzias latipes* - >12 and <33.9 mg/L -48-hr LC_{50} *Daphnia magna* - 22.9 mg/L **Terrestrial Toxicity** -In a phytotoxicity study with Lactuca sativa in soil and nutrient solution, a 14-day EC50 value of 43 mg/kg soil indicates moderate toxicity for plant growth. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Based on read-across to other group members, potential skin sensitiser. Potential to cause systemic long-term effects (genotoxicity). Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is 1.95 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that C.I. Basic Violet 10 (Rhodamine B or D&C Red No 19) is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., skin sensitiser). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Safety Guidance will be used to minimise human health exposure.
Calcined Petroleum coke	64743-05-1	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LL_{50} Pimephales promelas - >1,000 mg/L Acute Aquatic - Invertebrate -48-hr LL_{50} *Daphnia magna - >1,000 mg/L* Acute Aquatic - Algae and other plants -96-hr EL_{50} *Selenastrum capricornutum* - >1,000 mg/L **Terrestrial Toxicity** -14-day NOEC for *Eisenia fetida* (earthworms) - 1,000 mg/kg dw -21-day NOEC for corn, radish and soybeans - 1,000 mg/kg dw **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Coke is composed of elemental carbon and volatile matter, which are water-insoluble and not bioavailable. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that calcined petroleum coke is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Calcium aluminate	12042-68-1	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Daphnia rerio* - >100 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 5.4 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Desmodescus subspicatus* - 3.6 mg/L Chronic Aquatic - Algae and other plants -72-hr EC_{50} *Desmodescus subspicatus* - 2.6 mg/L **Terrestrial Toxicity** -No studies are available. Direct and indirect exposure of the soil and sediment compartment is unlikely. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Inorganic substances. PBT Assessment: Not applicable.	Environmental Fate Properties: Hydrates are not expected to bioaccumulate due to their low potential for bioavailability and moderate water solubility. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that calcium aluminate is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
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Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Calcium aluminate cement	65997-16-2	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Daphnia rerio* - >100 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 5.4 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Desmodescus subspicatus* - 3.6 mg/L Chronic Aquatic - Algae and other plants -72-hr EC_{50} *Desmodescus subspicatus* - 2.6 mg/L **Terrestrial Toxicity** -No studies are available. Direct and indirect exposure of the soil and sediment compartment is unlikely. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Inorganic substances. PBT Assessment: Not applicable.	Environmental Fate Properties: Hydrates are not expected to bioaccumulate due to their low potential for bioavailability and moderate water solubility. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that calcium aluminate cement is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Calcium carbonate	471-34-1	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* - >100% (saturated solution) Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - >100% (saturated solution) Acute Aquatic - Algae and other plants -72-hr EC_{50} *Desmodescus subspicatus* - >14 mg/L **Terrestrial Toxicity** -14-day NOEC for *Eisenia fetida* (earthworms) - >1,000 mg/kg dw -28-day NOEC for the inhibition of nitrogen transformation - >1,000 mg/kg dw **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Inorganic salt that dissociates completely to calcium and carbonate ions in aqueous solutions. PBT Assessment: Not applicable.	Environmental Fate Properties: Calcium and carbonate ions are essential to all living organisms and their intracellular and extracellular concentrations are actively regulated. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. Human Health (NICNAS, 2017) -Low concern for workers and the public Environment (DoEE, 2017) -Based on an assessment of environmental hazards, identified as a chemical of low concern to the environment. **PBT Assessment:** The overall conclusion is that calcium carbonate is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Calcium lignosulfonate	8061-52-7	**Aquatic Toxicity** -No data are available **Terrestrial Toxicity** -No data are available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Due to its high-molecular weight, calcium lignosulfonate is not expected to be bioavailable. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that calcium lignosulfonate is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Calcium oxide	1305-78-8	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* - 50.6 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - 49.1 mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Pseudokirchneriella subcapitata* - 184.57 mg/L **Terrestrial Toxicity** -14-day NOEC for *Eisenia fetida* (earthworms) - >1,000 mg/kg dw -28-day NOEC for the inhibition of nitrogen transformation - >1,000 mg/kg dw **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern. Slightly irritating to skin and corrosive to the eyes. It is not a skin sensitiser. It has an oral LD_{50} >2,000 mg/kg. No systemic toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Will disassociate in the environment to its respective cation and anion as limited by its aqueous solubility and pH PBT Assessment: Not applicable.	Environmental Fate Properties: Calcium and hydroxyl ions are essential to all living organisms, and their intracellular, and extracellular concentrations are actively regulated. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework. Environment (DoEE, 2017) -Based on an assessment of environmental hazards, identified as a chemical of low concern to the environment. **PBT Assessment:** The overall conclusion is that calcium oxide is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., corrosive to the eyes). It is a low concern to the environment. Management: Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Calcium sulfate	7778-18-9	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oryzias latipes* - >100 mg/L Acute Aquatic - Invertebrate -48-hr LC_{50} *Daphnia magna* - >100 mg/L Chronic Aquatic - Algae -7-day EC_{50} *Selenastrum capricornutum* - >100 mg/L **Terrestrial Toxicity** No data available. **$PNEC_{water}$** - Not derived **$PNEC_{soil}$** - Not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Will disassociate in the environment to its respective cation and anion that are ubiquitous to the environment. PBT Assessment: Not applicable.	Environmental Fate Properties: These ions are also essential to all living organisms (flora and fauna) and their intracellular and extra-cellular concentrations are actively regulated. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that calcium sulfate is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
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Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Calcium sulfate dihydrate	10101-41-4	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oryzias latipes* - >100 mg/L Acute Aquatic - Invertebrate -48-hr LC_{50} *Daphnia magna* - >100 mg/L Chronic Aquatic - Algae -7-day EC_{50} *Selenastrum capricornutum* - >100 mg/L **Terrestrial Toxicity** No data available. **$PNEC_{water}$** - Not derived **$PNEC_{soil}$** - Not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Will disassociate in the environment to its respective cation and anion that are ubiquitous to the environment. PBT Assessment: Not applicable.	Environmental Fate Properties: These ions are also essential to all living organisms (flora and fauna) and their intracellular and extra-cellular concentrations are actively regulated. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that calcium sulfate dihydrate is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Calcium sulfate hemihydrate	10034-76-1	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oryzias latipes* - >100 mg/L Acute Aquatic - Invertebrate -48-hr LC_{50} *Daphnia magna* - >100 mg/L Chronic Aquatic - Algae -7-day EC_{50} *Selenastrum capricornutum* - >100 mg/L **Terrestrial Toxicity** No data available. **$PNEC_{water}$** - Not derived **$PNEC_{soil}$** - Not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Will disassociate in the environment to its respective cation and anion that are ubiquitous to the environment. PBT Assessment: Not applicable.	Environmental Fate Properties: These ions are also essential to all living organisms (flora and fauna) and their intracellular and extra-cellular concentrations are actively regulated. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS/AICIS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that calcium sulfate hemihydrate is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Carbon	7440-44-0	**Aquatic Toxicity** *Based on read-across using graphite.* Acute Aquatic - Fish -96-hr LC_{50} *Danio rerio* - >100 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - >100 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - >100 mg/L **Terrestrial Toxicity** -No data available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Inorganic minerals PBT Assessment: Not applicable	Environmental Fate Properties: Completely insoluble in water. In view of their insolubility, there is no bioaccumulation potential under realistic natural conditions PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that carbon is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Carbon black	1333-86-4	**Aquatic Toxicity** *Based on read-across using graphite.* Acute Aquatic - Fish -96-hr LC_{50} *Danio rerio* - >100 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - >100 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - >100 mg/L **Terrestrial Toxicity** -No data available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Inorganic minerals PBT Assessment: Not applicable	Environmental Fate Properties: Completely insoluble in water. In view of their insolubility, there is no bioaccumulation potential under realistic natural conditions PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that carbon black is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Cellulose	9004-34-6	**Aquatic Toxicity** -No data are available -Woody materials that have not been chemically treated are not considered to be directly toxic to biota. Nevertheless, organic matter such as cellulose can act as non-toxic stressors that have direct or indirect effects on aquatic ecosystems. However, in the aquatic environment, cellulose is expected to become part of the aquatic carbon cycle. **Terrestrial Toxicity** -No data are available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Not expected to bioaccumulate due to its high molecular weight and potential for complete degradation PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that cellulose is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
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Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Cyclohexanedimethanol diglydicyl ether	14228-73-0	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* - 17.5 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 16.3 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - 26.7 mg/L Chronic Aquatic -21-day NOEC *Daphnia magna* - 11.7 mg/L -72-hr NOEC *Raphidocelis subcapitata* - 21.4 mg/L **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Cyclohexanedimethanol diglydicyl ether is slightly irritating to skin. It is not a skin sensitiser. It has a low oral LD_{50} >3,000 mg/kg. It has low oral repeat dose toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is 2.29 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that cyclohexanedimethanol diglydicyl ether is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., slightly irritating). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
d-Glucopyranoside, C9-C11 alkyl oligomeric	132778-08-6	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Danio rerio* - 5.9 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 7 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Desmodesmus subspicatus* - 12.5 mg/L Chronic Aquatic -28-day NOEC Zebrafish - 1.8 mg/L -21-day NOEC *Daphnia magna* - 2 mg/L -72-hr NOEC *Skeletonema costatum* - 1.8 mg/L **Terrestrial Toxicity** -14-day LC_0 *Eisenia fetida* (worms) - >654 mg/kg soil dw **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Irritating to skin and eyes. It is not a skin sensitiser. It has low oral acute toxicity and low oral repeat dose toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is <-0.07 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that d-glucopyranoside, C9-C11 alkyl oligomeric is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., irritant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Diatomaceous earth	61790-53-2	**Aquatic Toxicity** -No data are available **Terrestrial Toxicity** -No data are available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Hazard: Inhalation: silicosis and lung cancer in humans (based on read-across to crystalline silica). Oral/dermal: low concern. Ecological Hazard: Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not relevant PBT Assessment: Substance is an inorganic solid. Criteria is not applicable.	Environmental Fate Properties: water-insoluble mineral; not bioavailable PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Based on an assessment of environmental hazards, NICNAS identified members of this group (crystalline silica, quartz, cristobalite and tridymite and diatomaceous earth, calcined) as chemicals of low concern to the environment (DoEE, 2017). **PBT Assessment:** The overall conclusion is that diatomaceous earth is not a PBT substance. Qualitative Assessment indicated hazardous to human health by the inhalation pathway; not hazardous by the oral/dermal route (based on read-across). Diatomaceous earth is not expected to cause adverse effects in environmental receptors. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure. No additional management required with regard to the environment.
Diethylene glycol monoethyl ether	111-90-0	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Ictalurus punctatus (Channel catfish)* - 6,010 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - 1,982 mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - 14,861 mg/L Chronic Aquatic -30-day ChV fish - 1,561 mg/L -21-day ChV *Daphnia magna* - 480 mg/L -96-hr ChV *Green algae* - 415 mg/L **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern. Diethylene glycol monoethyl ether is not a skin or an eye irritant. It is not a skin sensitiser. It has low oral acute toxicity and low oral repeat dose toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is -0.54 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that diethylene glycol monoethyl ether is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

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Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Diethyltoluenediamine	68479-98-1	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Pimephales promelas* (Fathead minnow) - >106 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 5.8 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Desmodesmus subspicatus* - 104 mg/L Chronic Aquatic -72-hr EC_{10} *Green algae* - 54 mg/L **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern. Diethyltoluenediamine is irritating to skin and eyes. It is a skin sensitiser. It has moderate oral LD_{50} of 738 mg/kg. It has low oral repeat dose toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is 1.38 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that diethyltoluenediamine is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., irritant and sensitiser). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Dimethyl polysiloxane	63148-62-9	**Aquatic Toxicity** Acute Aquatic - Fish -96 hr - LC_{50} - 1.17 mg/L -96 hr - LC50 - 0.963-2.5203 mg/L Chronic Aquatic- Fish -7 day LC50 *Ictalurus punctatus* - 3.16 mg/L **Terrestrial Toxicity** Chronic terrestrial -14-day NOEC Earthworms - 124 mg/kg bw/day -28-day - NOEC - *Folsomia candida* - 230 mg/kg bw/day -28- day NOEC soil microflora - > 1,000 mg/kg bw /day **$PNEC_{water}$** - 0.0632 mg/L **$PNEC_{soil}$** - 23 mg/kg bw/day	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Meets the screening criteria for persistence.	Environmental Fate Properties: No evidence of bioaccumulation. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Determined to be low concern polymer under the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) targeted tier I approach and concluded that it poses no unreasonable risk to human health and the environment. (AICIS, 2021). **PBT Assessment:** The overall conclusion is that dimethyl siloxanes and silicones is not a PBT substance. Qualitative assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Dimethylaminopropylamine	109-55-7	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Leuciscus idus melanotus* (Golden orfe fish) - 122 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 59.5 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - 34 mg/L Chronic Aquatic -22-day NOEC *Daphnia magna* - 3.64 mg/L -72-hr NOEC *Raphidocelis subcapitata* - 19.53 mg/L **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - 0.0364 mg/L **$PNEC_{soil}$** - 0.031 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Low concern. Is an eye and skin irritant. It is also a skin sensitiser. It has low acute toxicity by the oral, dermal and inhalation routes and does not exhibit systemic toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is -0.352 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that dimethylaminopropylamine is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., irritant and skin sensitiser). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Dipropylene glycol	25265-71-8	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Leuciscus idus melanotus* (Golden orfe fish) - 122 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 59.5 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - 34 mg/L Chronic Aquatic -22-day NOEC *Daphnia magna* - 3.64 mg/L -72-hr NOEC *Raphidocelis subcapitata* - 19.53 mg/L **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - 0.0364 mg/L **$PNEC_{soil}$** - 0.031 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Low concern. Dipropylene glycol is not irritating to the skin or eyes and is not a skin sensitiser. It has low acute toxicity via the oral, inhalation and dermal routes. Systemic effects to the liver and kidney were observed in repeat dose toxicity studies. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is -0.46 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that dipropylene glycol is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., systemic effects). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Epichlorohydrin	106-89-8	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Pimephales promelas* (Fathead minnow) - 10.6 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 23.9 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - 15 mg/L Chronic Aquatic -No studies available **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - 0.106 mg/L **$PNEC_{soil}$** - 0.0063 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Exhibits systemic long-term effects (carcinogenicity and reproductive toxicity), systemic acute effects (acute toxicity by oral, dermal and inhalation exposure) and local effects (corrosivity, skin sensitisation and respiratory irritation). Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is 0.45 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that epichlorohydrin is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., systemic effects, carcinogen). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Ethanol, 2-amino-, compounds with polyethylene glycol hydrogen sulfate C6-10-alkyl ether	70914-35-1	**Aquatic Toxicity** In developing a water quality guideline for alcohol ethoxylates (AEs), the toxicity data was normalised for a specific alkyl chain length or a specific number of ethylene oxide (EO) groups. The NOECs listed below were normalised to an alkyl chain length of C13.3 and EO of 8.2. There were chronic data for 13 species that belonged to 7 taxonomic groups (fish, crustacea, blue alga, diatoms, green alga, protozoa, and worms). Freshwater fish: 2 species, 720 to 1,500 µg/L. Freshwater crustaceans: 2 species, 590 to 860 µg/L. Freshwater rotifers: 1 species, Brachionus calyciflorus, 1,300 µg/L. Freshwater algae, diatoms and blue-green algae: 6 species, 200 to 8,700 µg/L. Freshwater mesocosms: 4 NOEC data for multiple species tests were 80, 80, 320 and 330 µg/L, although replication was insufficient to meet OECD (1992) requirements. Normalised data were 380, 380, 320 and 1,520 µg/L. **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - 0.14 mg/L (ANZG DGV) **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Irritant to eyes. It is not a skin sensitiser. Low acute toxicity. No systemic effects have been observed. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is 0.44 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that ethanol, 2-amino-, compounds with polyethylene glycol hydrogen sulfate C6-10-alkyl ether is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., irritant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Ethylenediaminetetraacetic acid, tetrasodium salt	64-02-8	**Aquatic Toxicity** Acute Aquatic - Fish -LC_{50} > 100 mg/L for Na_4EDTA and sodium salts Acute Aquatic - Invertebrate -24-hr EC50 - *Daphnia magna* - 480 to 790 mg/L Chronic Aquatic - fish -NOEC - zebra fish - >26.8 mg/L H_4EDTA Chronic Aquatic - Invertebrate -21-day NOEC - *Daphnia Magna* - 22 mg/L Aquatic - Algae -Ecb50, ECr50 - *Pseudokirchneriella subcapitata* - >100 mg/L -NOEC - *Pseudokirchneriella subcapitata* - 48.4 mg/L **Terrestrial Toxicity** No data available **$PNEC_{water}$** - 2.2 mg/L (chronic algae) **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not expected to biodegrade PBT Assessment: Meets the screening criteria for persistence.	Environmental Fate Properties: BCF of 1.1 - 1.8 in fish. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** While the OECD tests for ethylenediaminetetraacetic acid, tetrasodium salt indicate that the criteria for persistence is satisfied, it is believed to be ultimately biodegradable under environmental conditions. The overall conclusion is that ethylenediaminetetraacetic acid, tetrasodium salt is not a PBT substance. Qualitative assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Fatty acids, C14-18 and C16-18-unsatd.	67701-06-8	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Danio rerio* - >10,000 mg/L Acute Aquatic - Invertebrate -48-hr LC_{50} *Daphnia magna - >100 mg/L* Acute Aquatic - Algae and other plants -72-hr EL_{50} *Pseudokirchneriella subcapitata* - >110 mg/L Chronic Aquatic -21-day NOELR *Daphnia magna* (water flea) - >110 mg/L -72-hr NOEC *Desmodesmus subcapitatas* - >100 mg/L **Terrestrial Toxicity** -28-day NOEC in earthworms was >1000 mg/kg dw -14-day NOEC of 300 mg/kg for *Lycopersicon esculentum* and *Raphanus sativus* respectively, and 1000 mg/kg for *Avena sativa* **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Aquatic toxicity data indicate that substances with chain lengths > C14 exhibit no adverse effects up to their water solubility limits. Thus, does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: The bioavailability of fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol is expected to be low. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS/AICIS:** AICIS has evaluated this chemical and determined it is a chemical which is unlikely to require further regulation to manage risks to environment. **PBT Assessment:** The overall conclusion is that Fatty acids, C14-18 and C16-18-unsatd.is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
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Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Fatty acids, C8-18 and C18-unsatd., esters with pentaerythritol	85049-33-8	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oryzias latipes* (Japanese rice fish) - >1.9 mg/L* Acute Aquatic - Invertebrate -48-hr EC_{50} Daphnia magna (Water Flea) - 0.25 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - >0.85 mg/L* *Based on read-across, studies showed no effect up to the limit of water solubility Chronic Aquatic -No studies available. Currently under evaluation. **Terrestrial Toxicity** -No studies available. Fatty acids are expected to undergo rapid mineralization in both aquatic and terrestrial environments, making environmental persistence unlikely. **$PNEC_{water}$** -not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Potentially irritating/corrosive to the eyes. Low acute toxicity and low systemic toxicity. Ecological Hazard - Low Concern PBT Assessment: Aquatic toxicity data indicate that substances with chain lengths > C14 exhibit no adverse effects up to their water solubility limits. Thus, does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Fatty acids are considered to pose no risk to aquatic organisms from their bioconcentration and biomagnification properties. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that Fatty acids, C8-18 and C18-unsatd., esters with pentaerythritol is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Fly ash	68131-74-8	**Aquatic Toxicity** The ashes (residues), coal with higher content of free lime indicated slightly harmful effects to aquatic organisms whereas other ashes (residues), coal are not harmful to aquatic organisms. The heavy metal content of the tested substance had no influence on toxic effects on aquatic organisms. Measured data from the aquatic tests show that the bioavailability of the heavy metals is low. **Terrestrial Toxicity** -Terrestrial studies with earthworm, plants and microorganisms are available for fly ash and show only low toxicity at high test concentrations. The test substance is not classified as toxic or harmful. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Chemically and biologically inert Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Substance consists of inorganic oxides. PBT Assessment: Not applicable	Environmental Fate Properties: Oxides are naturally inorganic substances and as an inorganic complex are not expected to bioaccumulate. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that fly ash is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Glycine, n,n-{bis{2-bis(carboxymethyl)amino}ethyl}-, pentasodium salt	140-01-2	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* - >854 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia carinata - 310 mg/L* Chronic Aquatic -28-day NOEC *Melanotaenia fluviatilis* (Crimson-spotted rainbowfish) - 127 mg/L -18-day NOEC *Daphnia carinata* - 64 mg/L -23-day NOEC *Scenedesmus quadricauda* - >400 mg/L **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - 6.4 mg/L (chronic invertebrate) **$PNEC_{soil}$** - 8.3 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is -2 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that glycine, n,n-{bis{2-bis(carboxymethyl)amino}ethyl}-, pentasodium salt is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Granulated Blast Furnace Slag	65996-69-2	**Aquatic Toxicity** In general, it has been shown that ferrous slags of all types tested are not toxic to fish, aquatic invertebrates and algae in both short and long-term studies. **Terrestrial Toxicity** -Studies conducted on ferrous slag did not exhibit terrestrial toxicity in soil macroorganisms, soil microorganisms, arthropods, plants and birds. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Chemically and biologically inert Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Substance is an inorganic UVCB. PBT Assessment: Not applicable	Environmental Fate Properties: Bioaccumulation of trace elements released from slag, is negligible in the environment PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that granulated blast furnace slag is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Gypsum	13397-24-5	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oryzias latipes* - >100 mg/L Acute Aquatic - Invertebrate -48-hr LC_{50} *Daphnia magna* - >100 mg/L Chronic Aquatic - Algae -7-day EC_{50} *Selenastrum capricornutum* - >100 mg/L **Terrestrial Toxicity** No data available. **$PNEC_{water}$** - Not derived **$PNEC_{soil}$** - Not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Will disassociate in the environment to its respective cation and anion that are ubiquitous to the environment. PBT Assessment: Not applicable.	Environmental Fate Properties: These ions are also essential to all living organisms (flora and fauna) and their intracellular and extra-cellular concentrations are actively regulated. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that gypsum is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Hexamethylenediamine	124-09-4	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Pimephales promelas* (Fathead minnow fish) - 1,825 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} Daphnia magna (Water Flea) - 31.5 mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - >100 mg/L Chronic Aquatic -21-day NOEC *Daphnia magna (* Water flea) - 4.2 mg/L **Terrestrial Toxicity** -EC_{10} for *Eisenia foetida* (earthworms) -176.1 mg/kg soil dw **$PNEC_{water}$** -not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Skin and eye irritant. Low acute toxicity. Systemic toxicant. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Experimental Log Kow of 0.4 L/Kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that hexamethylenediamine is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., corrosive, systemic toxicant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Hexylene glycol	107-41-5	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} various species - 8,510 - 13,500 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 5,410 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - >429 mg/L Chronic Aquatic -34-day NOEC *Danio rerio* - >13.7 mg/L -21-day NOEC *Daphnia magna* - >105 mg/L -72-hr NOEC *Raphidocelis subcapitata* - 429 mg/L **Terrestrial Toxicity** -28-day NOEC soil microorganisms - 97.7 mg/kg dw **$PNEC_{water}$** - 1.37 mg/L (chronic fish) **$PNEC_{soil}$** - 0.018 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Low concern. Hexylene glycol is slightly irritating to eyes. It is not a skin sensitiser. It has low oral acute and repeat dose toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is 0 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that hexylene glycol is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., slightly irritating to eyes). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Humic acids, potassium salts, polymers with acrylamide, 2-methyl-2-[(1-oxo-2-propenyl)amino]-1-propanesulfonic acid, 4-(1-oxo-2-propenyl) morpholine and sodium 4- ethenylbenzenesulfonate, sodium salts	227951-37-3	**Aquatic Toxicity** -No studies are available. -Based on read-across to anionic polyacrylamide, low acute and chronic toxicity concern to aquatic organisms **Terrestrial Toxicity** No studies available. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: large molecular weight, water-soluble polymers. They are not expected to be readily biodegradable PBT Assessment: Does meet the criteria for persistence.	Environmental Fate Properties: not expected to be bioavailable to aquatic or terrestrial organisms PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** NICNAS has assessed Humic acids, potassium salts, polymers with acrylamide, 2-methyl-2-[(1-oxo-2-propenyl)amino]-1-propanesulfonic acid, 4-(1-oxo-2-propenyl) morpholine and sodium 4-ethenylbenzenesulfonate, sodium salts in an IMAP Tier 1 assessment and considers it a polymer of low concern. **PBT Assessment:** The overall conclusion is that Humic acids, potassium salts, polymers with acrylamide, 2-methyl-2-[(1-oxo-2-propenyl)amino]-1-propanesulfonic acid, 4-(1-oxo-2-propenyl) morpholine and sodium 4- ethenylbenzenesulfonate, sodium salts is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Hydroxyethyl cellulose	9004-62-0	**Aquatic Toxicity** -No studies are available. -Based on read-across to sodium carboxymethylcellulose, low acute and chronic toxicity concern to aquatic organisms **Terrestrial Toxicity** No studies available. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: not expected to be bioavailable to aquatic or terrestrial organisms PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. Human Health (NICNAS, 2017) -Low concern for workers and the public Environment (DoEE, 2017) -Based on an assessment of environmental hazards, identified as a chemical of low concern to the environment. **PBT Assessment:** The overall conclusion is that hydroxyethyl cellulose is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Iron oxide	1309-37-1	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Brachydanio rerio* - >50,000 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - *>100* mg/L Chronic Aquatic -72-hr NOEC *Pseudokirchneriella subcapitata* - >20 mg/L **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Iron oxide is an eye irritant. It has low acute toxicity. No systemic toxicity is reported. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: an inorganic salt that dissociates to iron and hydroxyl ions in aqueous solutions. Biodegradation is not applicable to these inorganic ions. PBT Assessment: Not applicable.	Environmental Fate Properties: an essential, homeostatically controlled element, the bioaccumulation potential is low. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that iron oxide is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., systemic effects). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Kaolin	1332-58-7	No ecotoxicity data available. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not relevant as substance is inorganic PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Not relevant as substance is inorganic PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that kaolin is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Limestone	1317-65-3	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* - >100% (saturated solution) Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - >100% (saturated solution) Acute Aquatic - Algae and other plants -72-hr EC_{50} *Desmodescus subspicatus* - >14 mg/L **Terrestrial Toxicity** -14-day NOEC for *Eisenia fetida* (earthworms) - >1,000 mg/kg dw -28-day NOEC for the inhibition of nitrogen transformation - >1,000 mg/kg dw **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Inorganic salt that dissociates completely to calcium and carbonate ions in aqueous solutions. PBT Assessment: Not applicable.	Environmental Fate Properties: Calcium and carbonate ions are essential to all living organisms and their intracellular and extracellular concentrations are actively regulated. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. Human Health (NICNAS, 2017) -Low concern for workers and the public Environment (DoEE, 2017) -Based on an assessment of environmental hazards, identified as a chemical of low concern to the environment. **PBT Assessment:** The overall conclusion is that limestone is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Magnesium chloride hexahydrate	7791-18-6	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Pimephales promelas* - 2,119 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - 548.4 mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Desmodescus subspicatus* - >100 mg/L Chronic Aquatic -21-day NOEC - *Daphnia magna* - 321 mg/L **Terrestrial Toxicity** -No studies available. Magnesium and chloride ions are ubiquitous in the environment and are found naturally in soil, water and sediment. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: An inorganic salt that dissociates completely to magnesium and chloride ions in aqueous solutions. Biodegradation is not applicable to these inorganic ions. PBT Assessment: Not applicable	Environmental Fate Properties: will dissociate to ions that are ubiquitous in the environment PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that magnesium chloride hexahydrate is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Metaphosphoric acid hexasodium salt	10124-56-8	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* - >100 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 485 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Desmodescus subspicatus* - >100 mg/L Chronic Aquatic -72-hr NOEC *Desmodescus subspicatus* - 32 mg/L **Terrestrial Toxicity** -No studies available. Due to the natural occurrence of the constituent breakdown products of the substance in the environment, it is expected that it would not be toxic. **$PNEC_{water}$** - 3.2 mg/L (chronic algae) **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Biodegradation testing is not relevant for metaphosphoric acid hexasodium salt as it is an inorganic phosphate. Further, metaphosphoric acid hexasodium salt will not persist in natural waters and instead will dissociate to its cationic and anionic forms. PBT Assessment: Not applicable	Environmental Fate Properties: Metaphosphoric acid hexasodium salt has low potential for bioaccumulation because it will hydrolyse to orthophosphate in an aquatic system. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that metaphosphoric acid hexasodium salt is not a PBT substance. Qualitative Assessment indicated a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied..

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
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Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Mica-group minerals	12001-26-2	**Aquatic Toxicity** -No data are available **Terrestrial Toxicity** -No data are available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Hazard: Inhalation: silicosis and lung cancer in humans (based on read-across to crystalline silica). Oral/dermal: low concern. Ecological Hazard: Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not relevant PBT Assessment: Substance is an inorganic solid. Criteria is not applicable.	Environmental Fate Properties: water-insoluble mineral; not bioavailable PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Based on an assessment of environmental hazards, NICNAS identified members of this group (crystalline silica, quartz, cristobalite and tridymite and diatomaceous earth, calcined) as chemicals of low concern to the environment (DoEE, 2017). **PBT Assessment:** The overall conclusion is that mica-group minerals is not a PBT substance. Qualitative Assessment indicated hazardous to human health by the inhalation pathway; not hazardous by the oral/dermal route (based on read-across). Mica-group minerals is not expected to cause adverse effects in environmental receptors. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Monopropylene glycol monooleate	1330-80-9	**Aquatic Toxicity** -No data is available. Aquatic toxicity is unlikely to occur as the substance is highly insoluble (solubility: 0.000009738 g/L at 25° C) in water **Terrestrial Toxicity** -No data is available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Estimated BCF of 2,006 L/Kg whole body ww. However, this value is likely to be overestimated. PBT Assessment: Does meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that monopropylene glycol monooleate is not a PBT substance. Qualitative Assessment indicated a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Natural graphite	7782-42-5	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Danio rerio* - >100 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - >100 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - >100 mg/L **Terrestrial Toxicity** -No data available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Inorganic minerals PBT Assessment: Not applicable	Environmental Fate Properties: Completely insoluble in water. In view of their insolubility, there is no bioaccumulation potential under realistic natural conditions PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that natural graphite is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Paraffin based petroleum oil	8012-95-1	**Aquatic Toxicity** -No data available. -It is not soluble in water and is comprised mostly of components with water solubility below 0.01 mg/L and, therefore, it is not possible to assess the acute toxicity of the substance to aquatic organisms. **Terrestrial Toxicity** -No data available. -Paraffin based petroleum oil is readily biodegradable and will not persist in the environment. Direct or indirect exposure of the soil compartment is unlikely **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Parrafin based petroleum oil may cause some skin and eye irritation. It is not a skin sensitiser. It has low acute oral toxicity and low potential for systemic effects. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is ->4 L/kg PBT Assessment: Does meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that paraffin based petroleum oil is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., skin and eye irritant). It is a low concern to the environment due to its rapid degradation. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Paraffins, petroleum, normal C5-20	64771-72-8	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Danio rerio* - >100 mg/L Acute Aquatic - Invertebrate -48-hr EL_{50} *Daphnia magna - >100 mg/L* Acute Aquatic - Algae and other plants -72-hr EL_{50} *Raphidocelis subcapitata* - >100 mg/L Chronic Aquatic -21-day NOELR *Daphnia magna* (water flea) - 1 mg/L -72-hr NOEL *Raphidocelis subcapitata* - >100 mg/L **Terrestrial Toxicity** -56-day EL10 in Eisenia fetida was 380.01 mg/kg dw (model) -28-day EL10 in Folsomia candida was 213.69 mg/kg dw (model) -21-day EL10 of 976.6 mg/kg dw and 630.65 mg/kg dw for Avena sativa and Brassica rapa, respectively (model) **$PNEC_{water}$** - 0.01 mg/L (chronic invertebrates) **$PNEC_{soil}$** -100 mg/kg ww (QSAR model)	Qualitative Assessment: Human Health Hazard - Low concern. Slightly irritating to the skin. Low acute toxicity. No systemic toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Calculated BCFs range between 338 L/Kg and 963 L/Kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that Paraffins, petroleum, normal C5-20 is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Poly(oxy-1,2-ethandiyl), a-(nonylphenyl)-w-hydroxy-	9016-45-9	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Pimephales promelas* - 0.218 mg/L -96-hr LC_{50} *Lepomis macrochirus* - 1.3 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Ceriodaphnia dubia* - 0.328 mg/L -48-hr LC_{50} *Daphnia* - 1.8 mg/L Acute Aquatic- Algae -48-hr EC_{50} *Pseudokirchneriella subcapitata* - 20-50 mg/L Chronic Toxicity-Fish -21-day NOEC *Oncorhynchus mykiss* - 0.048 mg/L -7-day NOEC *Ceriodaphnia dubia* - 0.285 mg/L Chronic Toxicity- Invertebrates -6-day NOEC *Daphnia Magna* - 1.0 mg/L Chronic Toxicity-Algae -96-hr NOEC *Pseudokirchneriella subcapitata* - 8 mg/L -120-hr (5 day) EC_{50} *Scenedesmus Opoliensis* - 37.4 mg/L **Terrestrial Toxicity** No data available. **$PNEC_{water}$**- 0.00096 mg/L **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low to moderate toxicity Ecological Hazard - moderate concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: BCF values in fish studies are <1.4 L/Kg PBT Assessment: Does not meet the criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that poly(oxy-1,2-ethandiyl), a-(nonylphenyl)-w-hydroxy- is not a PBT substance. Qualitative Assessment indicated low to moderate toxicity for human health. It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(dodecyloxy)-, ammonium salt	32612-48-9	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Danio rerio* - 25 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 86 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Pseudokirchneriella subcapitata* - 115 mg/L Chronic Aquatic -28-day NOEC fish - 37 mg/L (QSAR) -21-day NOEC invertebrates- 20 mg/L (QSAR) **Terrestrial Toxicity** -14-day NOEC for *Eisenia fetida* (earthworms) - 2,600 mg/kg soil dw -72-hr EC50 in plants (*Lactuca sative*) - 143 mg/kg-soil dw **$PNEC_{water}$** - 0.65 ug/L (ANZG for alcohol ethoxysulfates) **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Irritant to skin and eyes in neat form. It is not a skin sensitiser. Low acute toxicity. It has low repeat dose toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is -2.03 PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(dodecyloxy)-, ammonium salt is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., slightly irritating). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(tetradecyloxy)-, ammonium salt	27731-61-9	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Danio rerio* - 25 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 86 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Pseudokirchneriella subcapitata* - 115 mg/L Chronic Aquatic -28-day NOEC fish - 37 mg/L (QSAR) -21-day NOEC invertebrates- 20 mg/L (QSAR) **Terrestrial Toxicity** -14-day NOEC for *Eisenia fetida* (earthworms) - 2,600 mg/kg soil dw -72-hr EC50 in plants (*Lactuca sative*) - 143 mg/kg-soil dw **$PNEC_{water}$** - 0.65 ug/L (ANZG for alcohol ethoxysulfates) **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Irritant to skin and eyes in neat form. It is not a skin sensitiser. Low acute toxicity. It has low repeat dose toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is -2.03 PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(tetradecyloxy)-, ammonium salt is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., slightly irritating). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Poly(vinyl acetate)-poly(vinyl alcohol) polymer	25213-24-5	**Aquatic Toxicity** -No studies are available. -Expected to be low concern for toxicity to aquatic organisms. High molecular weight non-ionic polymers generally have low toxicity to aquatic life. These polymers cannot be absorbed across biological membranes in aquatic organisms, and therefore toxicity only occurs through indirect effects such as chelation of essential nutrients. **Terrestrial Toxicity** No studies available. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the criteria for persistence.	Environmental Fate Properties: Not expected to bioaccumulate because of its high molecular weight. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** NICNAS has assessed poly(vinyl acetate)-poly(vinyl alcohol) polymer in an IMAP Tier 1 assessment and considers it a polymer of low concern. **PBT Assessment:** The overall conclusion is that poly(vinyl acetate)-poly(vinyl alcohol) polymer is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Poly[oxy(methyl-1,2-ethanediyl)], α-(2-aminomethylethyl)-ω-(2-aminomethylethoxy)-	9046-10-0	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Leuciscus idus (Ide)* - >1,000 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 218* mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Desmodesmus subspicatus* - >500 mg/L Chronic Aquatic -21-day NOEC *Daphnia magna* (water flea) - 24.6 mg/L (QSAR) **Terrestrial Toxicity** -No studies available. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern. Corrosive to the skin and eyes. Low acute toxicity. No systemic toxicity data was available. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the criteria for persistence.	Environmental Fate Properties: Experimental Log Kow of 1.34 L/Kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that poly[oxy(methyl-1,2-ethanediyl)], α-(2-aminomethylethyl)-ω-(2-aminomethylethoxy)- is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., corrosive to skin and eyes). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Polyethylene	9002-88-4	**Aquatic Toxicity** -No studies are available. -Expected to be low concern for toxicity to aquatic organisms. High molecular weight non-ionic polymers generally have low toxicity to aquatic life. These polymers cannot be absorbed across biological membranes in aquatic organisms, and therefore toxicity only occurs through indirect effects such as chelation of essential nutrients. **Terrestrial Toxicity** No studies available. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the criteria for persistence.	Environmental Fate Properties: Not expected to bioaccumulate because of its high molecular weight. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that polyethylene is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Polyethylene glycol (C6-C10) alkyl ether, sulfate ammonium salt	68037-05-8	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Danio rerio* - 25 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 86 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Pseudokirchneriella subcapitata* - 115 mg/L Chronic Aquatic -28-day NOEC fish - 37 mg/L (QSAR) -21-day NOEC invertebrates- 20 mg/L (QSAR) **Terrestrial Toxicity** -14-day NOEC for *Eisenia fetida* (earthworms) - 2,600 mg/kg soil dw -72-hr EC50 in plants (*Lactuca sative*) - 143 mg/kg-soil dw **$PNEC_{water}$** - 0.65 ug/L (ANZG for alcohol ethoxysulfates) **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Irritant to skin and eyes in neat form. It is not a skin sensitiser. Low acute toxicity. It has low repeat dose toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the criteria for persistence.	Environmental Fate Properties: Log Kow is -2.03 PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that polyethylene glycol (C6-C10) alkyl ether, sulfate ammonium salt is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., slightly irritating). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Polyethylene terephthalate	25038-59-9	**Aquatic Toxicity** -No studies are available. -Expected to be low concern for toxicity to aquatic organisms. This polymer is chemically and biologically inert. **Terrestrial Toxicity** No studies available. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the criteria for persistence.	Environmental Fate Properties: Not expected to bioaccumulate because of its high molecular weight. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** NICNAS has assessed polyethylene terephthalate in an IMAP Tier 1 assessment and considers it a polymer of low concern. **PBT Assessment:** The overall conclusion is that polyethylene terephthalate is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Polyoxyethylene sorbitan trioleate	9005-70-3	**Aquatic Toxicity** -96-hr LL_{50} *Salmo gairdneri* - >1,000 [WAF] mg/L -96-hr LL_{50} *Oryzias latipes* - >1,000 [WAF] mg/L -48-hr EL_{50} *Daphnia magna* - >1,000 [WAF] mg/L -72-hr EL_{50} *Pseudokirchneriella subcapitata* - >1,000 [WAF] mg/L Chronic Aquatic - Invertebrate -21-day NOELR (no-observed-effect-loading-rate) in a *Daphnia* reproduction test for sorbitan stearate (CAS No. 1338-41-6) is 16 mg/L WAFA -72-hr NOELR (no-observed-effect-loading-rate) to *Pseudokirschneriella subcapitata* for sorbitan stearate was 560 mg/L [WAF] **Terrestrial Toxicity** -No data available. **$PNEC_{water}$** - 0.32 mg/L WAF (chronic invertebrates) **$PNEC_{soil}$** -10.3 mg/kg soil dry weight (equilibrium partitioning method)	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: modeled BCF values ranged from 36 to 92 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that polyoxyethylene sorbitan trioleate is not a PBT substance. Qualitative Assessment indicated a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
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Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Polyproplylene and polyethylene oxide copolymer	9003-11-6	**Aquatic Toxicity** -This polymer is practically non-toxic to aquatic organisms (LC50/EC50 >100 mg/L for the most sensitive species tested) on an acute basis. **Terrestrial Toxicity** No studies available. **$PNEC_{water}$** - 0.1 mg/L **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the criteria for persistence.	Environmental Fate Properties: Not expected to bioaccumulate because of its high molecular weight. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** NICNAS has assessed polyproplylene and polyethylene oxide copolymer in an IMAP Tier 1 assessment and considers it a polymer of low concern. **PBT Assessment:** The overall conclusion is that polyproplylene and polyethylene oxide copolymer is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Polypropylene	9003-07-0	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Danio rerio* - >100 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - 105.8 mg/L Acute Aquatic - Algae and other aquatic plants -72-hr EC_{50} *Desmodesmus subspicatus* ->100 mg/L Chronic Aquatic -No chronic studies available **Terrestrial Toxicity** No terrestrial toxicity studies **$PNEC_{water}$** - 0.1 mg/L (invertebrates) **$PNEC_{soil}$** - 0.0067 mg/kg soil dry weight (equilibrium partitioning method)	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the criteria for persistence.	Environmental Fate Properties: Not expected to bioaccumulate because of its high molecular weight. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** NICNAS has assessed polyproplylene in an IMAP Tier 1 assessment and considers it a polymer of low concern. **PBT Assessment:** The overall conclusion is that polyproplylene is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Polypropylene glycol monododecyl ether	9002-92-0	**Aquatic Toxicity** In developing a water quality guideline for alcohol ethoxylates (AEs), the toxicity data was normalised for a specific alkyl chain length or a specific number of ethylene oxide (EO) groups. The NOECs listed below were normalised to an alkyl chain length of C13.3 and EO of 8.2. There were chronic data for 13 species that belonged to 7 taxonomic groups (fish, crustacea, blue alga, diatoms, green alga, protozoa, and worms). Freshwater fish: 2 species, 720 to 1,500 µg/L. Freshwater crustaceans: 2 species, 590 to 860 µg/L. Freshwater rotifers: 1 species, Brachionus calyciflorus, 1,300 µg/L. Freshwater algae, diatoms and blue-green algae: 6 species, 200 to 8,700 µg/L. Freshwater mesocosms: 4 NOEC data for multiple species tests were 80, 80, 320 and 330 µg/L, although replication was insufficient to meet OECD (1992) requirements. Normalised data were 380, 380, 320 and 1,520 µg/L. **Terrestrial Toxicity** -NOEC values for soil invertebrates of 220 mg/kg and 1,000 mg/kg **$PNEC_{water}$** - 0.14 mg/L (ANZG DGV) **$PNEC_{soil}$** -7.32 mg/kg dw	Qualitative Assessment: Human Health Hazard - Low concern. Irritant to eyes. It is not a skin sensitiser. Low acute toxicity. No systemic effects have been observed. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the criteria for persistence.	Environmental Fate Properties: Measured BCFs < 387 PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that polypropylene glycol monododecyl ether is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., eye irritant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Polyvinyl alcohol	9002-89-5	**Aquatic Toxicity** -Limited data available. -In literature, studies on read-across polyvinyl alcohol (CAS RN 25213-24-5) reported a 72-hr ErC50 and 96-hr ErC50 of >1,000 mg/L in Raphidocelis subcapitata; EC50 (24hr and 48 hr) > 1,000 mg/L in Daphnia magna; and, LC50 > 1,000 mg/L in Danio rerio conducted in a fish embryo toxicity assay . **Terrestrial Toxicity** No studies available. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the criteria for persistence.	Environmental Fate Properties: Not expected to bioaccumulate because of its high molecular weight. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** NICNAS has assessed polyvinyl alcohol in an IMAP Tier 1 assessment and considers it a polymer of low concern. **PBT Assessment:** The overall conclusion is that polyvinyl alcohol is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Propanesulfonic acid, 2-methyl-2-[(1-oxo-2-propenyl)amino]-, monosodium salt, polymer with N,N-dimethyl-2-propenamide	92815-96-8	**Aquatic Toxicity** -No studies are available. -Expected to be low concern for toxicity to aquatic organisms. Due to poor solubility and high molecular weight not expected to be bioavailable. Does not contain any reactive functional groups. **Terrestrial Toxicity** No studies available. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the criteria for persistence.	Environmental Fate Properties: Not expected to bioaccumulate because of poor water solubility and high molecular weight PBT Assessment: Does not meet criteria for bioaccumulation	**PBT Assessment:** The overall conclusion is that propanesulfonic acid, 2-methyl-2-[(1-oxo-2-propenyl)amino]-, monosodium salt, polymer with N,N-dimethyl-2-propenamide is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Pumice	1332-09-8	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* - 260-310 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 1,700* mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Scenedesmus subspicatus* - >345.4 mg/L Chronic Aquatic -No studies available **Terrestrial Toxicity** -No studies available. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Biodegradation is not applicable to this inorganic substance. PBT Assessment: Not applicable	Environmental Fate Properties: Based on read-across to sodium silicate, will dissociate to ions that are ubiquitous in the environment PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that pumice is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Quaternary ammonium compounds, bis(hydrogenated tallow alkyl) dimethyl,salts with bentonite	68953-58-2	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} Freshwater rainbow trout- > ca. 500 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - > 100 mg/L -96-hr EC_{50} *Daphnia magna* - 300 mg/L -48-hr EC_{50} *Daphnia magna* - <500 mg/L -72-hr EC_{50} *Skeletonema costatum* - 23.8 mg/L -72-hr EC_{50} *Skeletonema costatum* - 82.3 mg/L -72-hr EC_{50} *Skeletonema coastatum* - >1,000 mg/L Acute Aquatic- Algae -72-hr EC_{50} *Scenedesmus subspicatus* - >100 mg/L Chronic Toxicity -21-day NOEC *Daphnia magna* - 3.2 mg/L -72-hour NOEC *Scenedesmus subspicatus* - 100 mg/L **Terrestrial Toxicity** -14-day NOEC values for soil invertebrates of 1,000 mg/kg - NOEC values in plants (Tritium aestivum and Raphanus sativus) - 100 mg/kg-soil dw **$PNEC_{water}$** - 0.064 mg/L (chronic invertebrates) **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low toxicity Ecological Hazard - low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Insoluble in water and is not bioavailable PBT Assessment: Does not meet the criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with bentonite is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with attapulgite	68953-57-1	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} Freshwater rainbow trout- > ca. 500 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - > 100 mg/L -96-hr EC_{50} *Daphnia magna* - 300 mg/L -48-hr EC_{50} *Daphnia magna* - <500 mg/L -72-hr EC_{50} *Skeletonema costatum* - 23.8 mg/L -72-hr EC_{50} *Skeletonema costatum* - 82.3 mg/L -72-hr EC_{50} *Skeletonema coastatum* - >1,000 mg/L Acute Aquatic- Algae -72-hr EC_{50} *Scenedesmus subspicatus* - >100 mg/L Chronic Toxicity -21-day NOEC *Daphnia magna* - 3.2 mg/L -72-hour NOEC *Scenedesmus subspicatus* - 100 mg/L **Terrestrial Toxicity** -14-day NOEC values for soil invertebrates of 1,000 mg/kg - NOEC values in plants (Tritium aestivum and Raphanus sativus) - 100 mg/kg-soil dw **$PNEC_{water}$** - 0.064 mg/L (chronic invertebrates) **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low toxicity Ecological Hazard - low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Insoluble in water and is not bioavailable PBT Assessment: Does not meet the criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with attapulgite is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides	92129-33-4	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Pimephales promelas* - 21.3 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - 3.1 mg/L Acute Aquatic - Algae and other aquatic plants -72-hr EC_{50} *Raphidocelis subcapitata* - 0.48 mg/L Chronic Aquatic - Algae -35-day NOEC *Pimephales promelas* - 0.23 mg/L -21-day NOEC Daphnia magna - 0.38 mg/L -5-day NOEC *Raphidocelis subcapitata - 0.062 mg/L* **Terrestrial Toxicity** -21-day NOEC >10,000 mg/kg dw for mung bean and >1,000 mg/kg dw for sunflower and great millet were identified based on growth **$PNEC_{water}$** - 0.0062 mg/L (chronic algae) **$PNEC_{soil}$** - Not derived	Qualitative Assessment: Human Health Hazard -Low concern. Irritant to the eyes. It has low acute toxicity via the oral, inhalation and dermal routes. Limited systemic toxicity was observed. Ecological Hazard - Harmful to aquatic life with long lasting effects. Low concern to terrestrial organisms. PBT Assessment: Does meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Measured BCF range between 32 L/Kg and 256 L/Kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides is not a PBT substance. Qualitative Assessment indicated human health hazard (e.g., eye irritant). This chemical is not readily biodegradable. However, it has a low potential for bioaccumulation. Additionally, the potential exposure to aquatic receptors is considered incomplete (refer to text). **Management:** Safe Work Australia and Santos Occupational Safety Guidance will be used to minimise human health exposure. Implementation of Constraints Protocol in EMP will be required to prevent accidental discharge/release.
Rape Oil	8002-13-9	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* - 192 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - 91 mg/L Acute Aquatic - Algae and other aquatic plants -72-hr EC_{50} *Desmodesmus subspicatus* - 39 mg/L Chronic Aquatic - Algae -35-day NOEC *Danio rerio* - 19.6 mg/L -21-day NOEC Daphnia magna - 1.34 mg/L **Terrestrial Toxicity** -NOEC of 3,550 mg/kg soil dw for soil invertebrates -10-day LDD_{50} of 1,420 ug/bee for honeybees **$PNEC_{water}$** - Not derived **$PNEC_{soil}$** - Not derived	Qualitative Assessment: Human Health Hazard - Low concern. Rape seed oil is of low acute oral, dermal and inhalation toxicity and not irritant to eyes and skin, or a skin sensitiser. No systemic toxicity has been reported. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the criteria for persistence.	Environmental Fate Properties: Rape oil is not considered to be bioaccumulative. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that rape oil is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Sepiolite	63800-37-3	**Aquatic Toxicity** *Based on read-across to magnesium silicate hydrate (talc)* Acute Aquatic -96-h LC_{50} Unnamed fish species - 89,581 mg/L (QSAR) -48-h LC_{50} Daphnid species - 36,812 mg/L (QSAR) -96 h LC50 Freshwater algae - 7,203 mg/L Chronic Aquatic - Fish No data available **Terrestrial Toxicity** No data available. **$PNEC_{water}$** - 72 mg/L **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Biodegradability is not relevant because inorganic substance. PBT Assessment: Not applicable.	Environmental Fate Properties: Bioaccumulation not expected to occur based on its log Kow value of -9.4. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that sepiolite is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Silane, dichlorodimethyl-, reaction products with silica	68611-44-9	**Acute Aquatic Toxicity** Acute Aquatic - Fish -72-hr LC_{50} Chanel Catfish (*Ictalurus punctatu* s) - 5.5 mg/L Acute Aquatic - Invertebrate -48-hour LC_{50} *Daphnia magna* - 44.5 mg/L Chronic Aquatic - Fish - 7-day LC_{50} - fish (*Ictalurus punctatus*) - 3.16 mg/L **Terrestrial Toxicity** -21-day NOEC *Eisenia foetida* (earthworms) - >1,100 mg/kg -28-day NOEC *Folsomia candida* (springtail) - 230 mg/kg -28-day NOEC Soil microflora - >1,000 mg/kg **$PNEC_{water}$** - 0.0632 mg/L (chronic fish) **$PNEC_{soil}$** - 23 mg/kg (chronic arthropod)	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Meets the screening criteria for persistence	Environmental Fate Properties: No evidence of bioaccumulation in aquatic or terrestrial organisms PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** No data was available for silane, dichlorodimethyl-, reaction products with silica. As a result, the information provided is based on polydimethylsiloxanes (PDMS). PDMS (CAS RN 63148-62-9) and Silane, dichlorodimethyl-, reaction products with silica are linear siloxanes. NICNAS has assessed PDMS in an IMAP Tier 1 assessment and considers it a polymer of low concern, and concluded that it poses no unreasonable risk to human health and the environment. **PBT Assessment:** The overall conclusion is that silane, dichlorodimethyl-, reaction products with silica is not a PBT substance. Qualitative assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Silicic acid, lithium magnesium sodium salt	53320-86-8	**Aquatic Toxicity** Acute Aquatic - Fish -48-hr LC_{50} *Leuciscus idus* (Ide)- >146 mg/L Acute Aquatic - Invertebrate -24-hr EC_{50} *Daphnia magna - >146* mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Scenedesmus subspicatus* - >345.4 mg/L Chronic Aquatic -No studies available. Due to the natural adaptation of organisms to silicon, it can be assumed that the additional input of anthropogenic soluble silicates will not lead to an increased hazard potential for aquatic organisms. Chronic aquatic toxicity is therefore not anticipated **Terrestrial Toxicity** -48-hr LD_{50} to honeybees was 25 µg/animal. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Silic acid, lithium magnesium sodium salt is mildly irritating to the skin and irritating to the eye. It is not a skin sensitiser. No treatment-related systemic effects have been observed. Ecological Hazard - Low Concern PBT Assessment: Does meet the screening criteria for toxicity.	Environmental Fate Properties: dissociates completely to potassium and silicate ions in aqueous solutions. Biodegradation is not applicable to these inorganic ions PBT Assessment: Not applicable.	Environmental Fate Properties: Potassium and silicate ions are essential to all living organisms and are ubiquitous in the environment. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that silicic acid, lithium magnesium sodium salt is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., slightly irritating). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Sodium aluminate	1302-42-7	**Aquatic Toxicity** Due to its chemical nature sodium aluminate is not stable under environmental conditions (pH-values between 4 and 9). The main decomposition products of sodium aluminate in water are 1) sodium hydroxide, 2) aluminium hydroxide and its dehydrate form, aluminium oxide. -The OECD-SIDS SIAR on NaOH states that while the toxicity of the NaOH has been assumed to be related to the hydroxyl anion, in general, a pH change could influence the speciation of other chemicals and therefore, increase and/or decrease toxicity of the substance. -Available data indicate that aluminium salts are relatively non-toxic in most waters with circumneutral pH. Factors that influence aluminium toxicity are consistent with the factors that influence aluminium speciation. These factors include pH, DOC, and water hardness. -In developing a water quality guideline for aluminium (ANZG, 2018), ANZG separated the screened freshwater toxicity data into those conducted at pH >6.5 and those at pH <6.5. **Terrestrial Toxicity** -Negligible terrestrial toxicity (ECHA) **$PNEC_{water}$** - 0.055 mg/L (ANZG DGV PH>6.5); 0.008 mg/L (ANZG DGV PH<6.5) **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Sodium aluminate is corrosive to the skin and eyes. It is not a skin sensitiser. It has an oral LD_{50} >2,000 mg/kg. Systemic effects associated with neurotoxicity have been identified from repeated dose toxicity studies. Ecological Hazard - Moderate Concern. Available data indicate that decomposition product aluminium salts while toxic under acidic conditions, are relatively non-toxic in most waters with circumneutral pH. Factors that influence aluminium toxicity are consistent with the factors that influence aluminium speciation. These factors include pH, dissolved organic carbon (DOC), and water hardness. PBT Assessment: Does meet the screening criteria for toxicity.	Environmental Fate Properties: dissociates completely in water to sodium (Na+), aluminium (Al3+) and hydroxyl (OH-) ions. Biodegradation is not applicable to these inorganic ions. PBT Assessment: Not applicable.	Environmental Fate Properties: hydrolysed rapidly to form insoluble aluminum hydroxide and free sodium ions. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that sodium aluminate is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., corrosive to the skin and eyes). This chemical has a low potential for bioaccumulation. Available data indicate that aluminium salts are relatively non-toxic in most waters with circumneutral pH. Additionally, the potential exposure to aquatic receptors is considered incomplete (refer to text). **Management:** Safe Work Australia and Santos Occupational Safety Guidance will be used to minimise human health exposure. Implementation of Constraints Protocol in EMP will be required to prevent accidental discharge/release.
Sodium dicyclohexyl sulfosuccinate	23386-52-9	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Lepomis macrochiru* (Bluegill sunfish) - 451.2 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 439 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Desmodesmus subspicatus* (Green alga) - 903 mg/L Chronic Aquatic -33-day NOEC *Pimephales promelas* - 10.7 mg/L -21-day EC_{10} Daphnia magna - >14.6 mg/L -72-hr EC_{10} *Desmodesmus subspicatus (Green alga)* - 903 mg/L **Terrestrial Toxicity** -No studies available. The registered substance is an ionic substance, has a log Pow of < 3 and is inherently biodegradable. Accumulation in soil organisms and persistence in soil compartment are therefore very unlikely. **$PNEC_{water}$** -1.07 mg/L (chronic fish) **$PNEC_{soil}$** -1.21 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Low concern. Is irritating to skin and eyes. It is not a skin sensitiser. It has low acute toxicity via the oral and dermal routes. It is not a systemic toxicant. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Inherently biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Low Kow is -1.504 L/kg and a measured BCF of 9.33 L/Kg. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that Sodium dicyclohexyl sulfosuccinate is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., skin and eye irritant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Sodium dodecyl diphenyl ether disulfonate	119345-04-9	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Pimephales promelas* (Fathead minnow fish) - 1.3 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 1.64* mg/L Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - 840 mg/L Chronic Aquatic -33-day NOEC to Pimephales promelas (Fathead minnow fish) - 0.15 mg/L -21-d NOEC in a Daphnia 1 mg/L -96-hr NOEC to Selenastrum capricornutum 298 mg/L **Terrestrial Toxicity** -28-day NOEC to Eisenia fetida (earthworm) of 1,000 mg/kg dw **$PNEC_{water}$** - 0.015 mg/L (chronic fish) **$PNEC_{soil}$** - 6.9 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Moderate concern. Corrosive to the eyes. It is not a skin sensitiser. It has low oral and dermal acute toxicity. Reproductive toxicant. Ecological Hazard - Toxic to aquatic life with long lasting effects. Low concern to terrestrial organisms. PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Measured BCF <14 L/Kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that sodium dodecyl diphenyl ether disulfonate is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., corrosive to the eyes, reproductive toxicant). This chemical has a low potential for bioaccumulation. The substance exhibits low to moderate aquatic toxicity. AICIS concluded that it is unlikely to have unpredictable long-term effects, and that the environmental risk from the introduction of the assessed chemical can be managed. Additionally, the potential exposure to aquatic receptors is considered incomplete (refer to text). **Management:** Safe Work Australia and Santos Occupational Safety Guidance will be used to minimise human health exposure. Implementation of Constraints Protocol in EMP will be required to prevent accidental discharge/release.
Sodium Fluorescein	518-47-8	**Aquatic Toxicity** Acute Aquatic - Fish -96hr LC_{50} Rainbow trout-1372 mg/L Acute Aquatic - Invertebrate -48hr LC_{50} *Daphnia pulex* -337 mg/L Acute Aquatic - Algae and other aquatic plants -72hr EC_{50} *Chlorella vulgaris* -209.24 mg/L **Chronic Toxicity** Chronic Aquatic - Invertebrate -10-day LC_{50} *Daphnia pulex* -721 mg/L Chronic Aquatic - Algae and other aquatic plants -96hr EC_{50} Green algae-<10 mg/L **Terrestrial Toxicity** No data available **$PNEC_{water}$** - 2.1 mg/L **$PNEC_{soil}$** - 2.5 mg/kg	Qualitative Assessment: Human Health Hazard - May cause irritation to the skin and eyes Ecological Hazard -Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Experimental log Kow is 0.34 and the BCF value is <0.27 L/kg PBT Assessment: Does not meet the criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that sodium fluorescein is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., irritating to the skin and eyes). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Sodium Formate	141-53-7	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* - >1,000 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - >1,000 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - >1,000 mg/L Chronic Aquatic -21-day Daphnia magna - 100 mg/L -72-hr NOEC *Raphidocelis subcapitata* - 500 mg/L **Terrestrial Toxicity** -No studies available. **$PNEC_{water}$** -not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Not irritating to skin and eyes. It is not a skin sensitiser. Low acute toxicity. No systemic toxicity reported. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is -1.8 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that sodium formate is not a PBT substance. Qualitative Assessment indicated it is a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Sodium gluconate	527-07-1	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oryzias latipes* - >100 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - >1000 mg/L Acute Aquatic - Algae -72-hr E_rC_{50} *Selenastrum capricornutum* - > 1000 mg/L Chronic Aquatic - Algae -72-hr NOEC *Selenastrum capricornutum* - 560 mg/L **Terrestrial Toxicity** No data available. **$PNEC_{water}$** - 5.6 mg/L (Acute Fish) **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: -Measured log Kow -5.99 PBT Assessment: Does not meet the criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that sodium gluconate is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Sodium lauryl ether sulfate	9004-82-4	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Danio rerio* - 25 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 86 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Pseudokirchneriella subcapitata* - 115 mg/L Chronic Aquatic -28-day NOEC fish - 37 mg/L (QSAR) -21-day NOEC invertebrates- 20 mg/L (QSAR) **Terrestrial Toxicity** -14-day NOEC for *Eisenia fetida* (earthworms) - 2,600 mg/kg soil dw -72-hr EC50 in plants (*Lactuca sative*) - 143 mg/kg-soil dw **$PNEC_{water}$** - 0.65 ug/L (ANZG for alcohol ethoxysulfates) **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Irritant to skin and eyes in neat form. It is not a skin sensitiser. Low acute toxicity. It has low repeat dose toxicity. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is -2.03 PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that sodium laurel ether sulfate is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., slightly irritating). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Sodium nitrate	7631-99-4	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Cyprinus carpio* (Common carp fish) - 346 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Ceriodaphnia silvestrii* (Water flea) - *340 mg/L* Acute Aquatic - Algae and other plants -72-hr EC_{50} *Raphidocelis subcapitata* - 71 mg/L Chronic Aquatic -30-day NOEC *Pimephales promelas* (Fathead minnow fish) - 257 mg/L -7-day NOEC *Ceriodaphnia dubia* (Water flea) - 69 mg/L -72-hr EC_{50} *Raphidocelis subcapitata* (Green algae)- >71 mg/L **Terrestrial Toxicity** -An LC_{100} of 5,280 ppm (day 3 post treatment) and 5,940 ppm (day 4 post treatment) were determined in *Coturnix coturnix* japonica (Japanese quail) **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Sodium nitrate does not cause skin irritation and is not a skin sensitiser but is considered an eye irritant. It has an oral LD50 > 2,000 mg/kg bw. Limited systemic toxicity was observed for potassium nitrate, a structurally similarly compound. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: an inorganic salt that dissociates completely to sodium and nitrate ions in aqueous solutions. Biodegradation is not applicable to these inorganic ions. PBT Assessment: Not applicable.	Environmental Fate Properties: sodium nitrate dissociates to sodium and nitrate ions, neither sodium nitrate nor its dissociated ions are expected to bioaccumulate. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health and the environment based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that sodium nitrate is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., eye irritant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Sodium polyphosphate	68915-31-1	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} fish - 100 mg/L (QSAR) Acute Aquatic - Invertebrate -48-hour EC_{50} *Daphnia magna* - >100 mg/L Acute Aquatic - Algae and other plants -72-hr EC50 - *Desmodesmus subspicatus* - >100 mg/L Chronic Aquatic - Fish -72-hr NOEC - *Desmodesmus subspicatus* - 100 mg/L **Terrestrial Toxicity** -14-day LC_{50} *Eisenia foetida* (earthworms) - >3,500 mg/kg soil dw **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern. Sodium polyphosphate may be irritating to skin and eyes. It is not known to be a skin sensitiser. It has an oral LD50 of 2650 mg/kg bw. Oral repeat dose studies indicate this compound has a low potential for systemic effects. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: an inorganic salt that dissociates to its respective cations and anions in aqueous solutions. Biodegradation is not applicable to these inorganic ions. PBT Assessment: Not applicable	Environmental Fate Properties: Sodium and phosphate ions are essential to all living organisms and their intracellular and extracellular concentrations are actively regulated. PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that sodium polyphosphate is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., skin and eye irritant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Sodium salt of sulfonated naphthaleneformaldehyde condensate	9084-06-4	**Aquatic Toxicity** *Based on read-across* Acute Aquatic - Fish -96-hr LC_{50} - 105,000 mg/L (QSAR) Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - 49,421 mg/L (QSAR) Acute Aquatic - Algae and other aquatic plants -72-hr EC_{50} *Pseudokirchnerella subcapitata* - 4,768 mg/L (QSAR) **Terrestrial Toxicity** -No data available. **$PNEC_{water}$** -Not derived **$PNEC_{soil}$** - Not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the criteria for persistence.	Environmental Fate Properties: Log Kow <1 (group members) PBT Assessment: Does not meet criteria for bioaccumulation	**PBT Assessment:** The overall conclusion is that Sodium salt of sulfonated naphthaleneformaldehyde condensate is not a PBT substance Qualitative assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Sorbitan, monopalmitate	26266-57-9	**Aquatic Toxicity** -96-hr LL_{50} *Salmo gairdneri* - >1,000 [WAF] mg/L -96-hr LL_{50} *Oryzias latipes* - >1,000 [WAF] mg/L -48-hr EL_{50} *Daphnia magna* - >1,000 [WAF] mg/L -72-hr EL_{50} *Pseudokirchneriella subcapitata* - >1,000 [WAF] mg/L **Chronic Aquatic - Invertebrate** -21-day NOELR (no-observed-effect-loading-rate) in a *Daphnia* reproduction test for sorbitan stearate (CAS No. 1338-41-6) is 16 mg/L WAFA -72-hr NOELR (no-observed-effect-loading-rate) to *Pseudokirschneriella subcapitata* for sorbitan stearate was 560 mg/L [WAF] **Terrestrial Toxicity** -No data available. **$PNEC_{water}$** - 0.32 mg/L WAF (chronic invertebrates) **$PNEC_{soil}$** -10.3 mg/kg soil dry weight (equilibrium partitioning method)	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: modeled BCF values ranged from 36 to 92 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that sorbitan, monopalmitate is not a PBT substance. Qualitative Assessment indicated a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Sorbitan, tri,(9Z)-9-octadecenoate	26266-58-0	**Aquatic Toxicity** -96-hr LL_{50} *Salmo gairdneri* - >1,000 [WAF] mg/L -96-hr LL_{50} *Oryzias latipes* - >1,000 [WAF] mg/L -48-hr EL_{50} *Daphnia magna* - >1,000 [WAF] mg/L -72-hr EL_{50} *Pseudokirchneriella subcapitata* - >1,000 [WAF] mg/L **Chronic Aquatic - Invertebrate** -21-day NOELR (no-observed-effect-loading-rate) in a *Daphnia* reproduction test for sorbitan stearate (CAS No. 1338-41-6) is 16 mg/L WAFA -72-hr NOELR (no-observed-effect-loading-rate) to *Pseudokirschneriella subcapitata* for sorbitan stearate was 560 mg/L [WAF] **Terrestrial Toxicity** -No data available. **$PNEC_{water}$** - 0.32 mg/L WAF (chronic invertebrates) **$PNEC_{soil}$** -10.3 mg/kg soil dry weight (equilibrium partitioning method)	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: modeled BCF values ranged from 36 to 92 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that sorbitan, tri,(9Z)-9-octadecenoate is not a PBT substance. Qualitative Assessment indicated a low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Styrene / 1,3 Butadiene copolymer	9003-55-8	**Aquatic Toxicity** -No studies are available. -Expected to be low concern for toxicity to aquatic organisms. High molecular weight anionic polymers (including water-soluble polyanions) generally have low toxicity to fish and aquatic invertebrates. These polymers cannot be absorbed across biological membranes in aquatic organisms, and therefore toxicity only occurs through indirect effects such as chelation of essential nutrients. **Terrestrial Toxicity** No studies available. **$PNEC_{water}$** - not derived **$PNEC_{soil}$** - not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not expected to be readily biodegradable PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Not expected to bioaccumulate because of its high molecular weight PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** NICNAS has assessed the substance in an IMAP Tier 1 assessment and considers it a polymer of low concern. **PBT Assessment:** The overall conclusion is that Styrene / 1,3 Butadiene copolymer is not a PBT substance. Qualitative assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Sulfonated organic polymer	526203-62-3	**Aquatic Toxicity** *Based on read-across* Acute Aquatic - Fish -96-hr LC_{50} - 105,000 mg/L (QSAR) Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - 49,421 mg/L (QSAR) Acute Aquatic - Algae and other aquatic plants -72-hr EC_{50} *Pseudokirchnerella subcapitata* - 4,768 mg/L (QSAR) **Terrestrial Toxicity** -No data available. **$PNEC_{water}$** -Not derived **$PNEC_{soil}$** - Not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Not readily biodegradable PBT Assessment: Does meet the criteria for persistence.	Environmental Fate Properties: Log Kow <1 (group members) PBT Assessment: Does not meet criteria for bioaccumulation	**PBT Assessment:** The overall conclusion is that sulfonated organic polymer is not a PBT substance Qualitative assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Triazine	290-87-9	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* - >119 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - 26.1* mg/L Acute Aquatic - Algae and other plants -72-hr *Raphidocelis subcapitata* - 239 mg/L Chronic Aquatic -48-hr EC_{10} *Raphidocelis subcapitata* - 99 mg/L **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - 0.99 mg/L (chronic algae) **$PNEC_{soil}$** -0.097 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Moderate concern. Slightly irritating to the eye. It is a skin sensitiser. Moderate acute toxicity. Systemic toxicant. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the criteria for persistence.	Environmental Fate Properties: Experimental Log Kow of -0.163 L/Kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that triazine is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., eye irritant, systemic toxicant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Triazinetriethanol	4719-04-4	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Brachydanio rerio* - 16.07 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna* - 11.9 mg/L Acute Aquatic - Algae and other aquatic plants -72-hr EC_{50} *Desmodesmus subspicatus* - 6.66 mg/L Chronic Aquatic - Algae -72-hr NOEC *Desmodesmus subspicatus* - 1.56 mg/L **Terrestrial Toxicity** -No studies available. As direct exposure of the soil compartment is unlikely and because the substance is readily biodegradable, study on toxicity to terrestrial organisms is not mandatory. **$PNEC_{water}$** - 0.031 mg/L (chronic algae) **$PNEC_{soil}$** - 0.02 mg/kg dw (equilibrium partitioning)	Qualitative Assessment: Human Health Hazard - Low concern. Irritating to the eye. It is a skin sensitiser. Low to moderate acute toxicity by the oral and dermal routes. Systemic toxicant. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is -2 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS/AICIS:** AICIS has evaluated this chemical and determined it is a chemical which is unlikely to require further regulation to manage risks to environment. **PBT Assessment:** The overall conclusion is that triazinetriethanol is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., eye irritant, skin sensitiser, systemic toxicant). It is a low concern to the environment. **Management:** Safe Work Australia and Santos Occupational Health & Safety procedures will be used to minimise human health exposure.
Walnut, Juglans regia, ext	84012-43-1	**Aquatic Toxicity** -No data are available -Woody materials that have not been chemically treated are not considered to be directly toxic to biota. Nevertheless, organic matter such as woody materials can act as non-toxic stressors that have direct or indirect effects on aquatic ecosystems. However, in the aquatic environment, wood products can be viewed as particulate organic matter and are expected to become part of the aquatic carbon cycle **Terrestrial Toxicity** -No data are available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern. Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Expected to degrade over time under typical environmental conditions PBT Assessment: Does meet the screening criteria for persistence.	Environmental Fate Properties: Not bioaccumulative PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that walnut hulls is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.
Welan gum	72121-88-1	**Aquatic Toxicity** Acute Aquatic - Fish -96-hr LC_{50} *Oncorhynchus mykiss* - >100 mg/L Acute Aquatic - Invertebrate -48-hr EC_{50} *Daphnia magna - >100* mg/L Acute Aquatic - Algae and other plants -72-hr *Desmodesmus subspicatus* - >100 mg/L Chronic Aquatic -No studies available **Terrestrial Toxicity** -No studies available **$PNEC_{water}$** - not derived **$PNEC_{soil}$** -not derived	Qualitative Assessment: Human Health Hazard - Low concern Ecological Hazard - Low Concern PBT Assessment: Does not meet the screening criteria for toxicity.	Environmental Fate Properties: Readily biodegradable PBT Assessment: Does not meet the screening criteria for persistence.	Environmental Fate Properties: Log Kow is -3.56 L/kg PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**PBT Assessment:** The overall conclusion is that welan gum is not a PBT substance. Qualitative Assessment indicated low concern to human health and the environment. **Management:** No additional management required, Tier 1 screening satisfied.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical Name	CAS Number	Ecotoxicity[1]	Toxicity[1]	Biodegradation[1]	Bioaccummulative[1]	Discussion
Zinc oxide	1314-13-2	**Aquatic Toxicity** The ANZG water quality guideline (2021) derived very high reliability default guideline values (DGVs) for zinc in freshwater from 85 data points covering 6 taxonomic groups, and these were adjusted to a common hardness of 30 mg/L as CaCO3 and other endpoints adjusted to NOECs as follows (pH range was 6.75 to 8.39): -Fish: 11 species, 24 µg/L (Oncorhynchus tshawytscha; from LC50) to 1316 µg/L (Ptylocheilus oregonensis; from LC50); seven species had geometric means < 250 µg/L and a measured NOEC of 38 µg/L was reported for Pimephales promelas. -Amphibians: one species, Ambystoma opacum, 180 µg/L (from LOEC). -Crustaceans: three species, 5.5 µg/L (C. dubia; from LC50) to 25.3 µg/L (C. dubia), plus a figure of 18,480 for the crayfish Orconectes virillis). -Insect: one species, Tanytarsus dissimilis, 5 µg/L (NOEC). -Molluscs: three species, 54 µg/L (Dreissena polymorpha) to 11,200 µg/L (Velesunio ambigua), a NOEC of 487 µg/L was measured for Physa gyrina. -Annelid: one species, Limnodrilus hoffmeisteri, 560 µg/L (from LC50). **Terrestrial Toxicity** -Reliable chronic toxicity data are available for the long-term effect of zinc on 35 terrestrial species or microbial endpoints covering the 3 trophic levels (12 terrestrial plants, 10 invertebrates and 13 microbial endpoints). A total of 220 reliable EC10 and NOEC values, ranging between 31.2 and 8003.5 mg Zn/kg dry weight (dw). All results were derived for soluble zinc substances (Zn(CH3COO)2, ZnCl2, Zn(NO3)2 or ZnSO4, including hydrated forms). **$PNEC_{water}$** - 0.008 mg/L (ANZG DGV) **$PNEC_{soil}$** -20-330 mg added Zn/Kg (ASC NEPM EIL)	Qualitative Assessment: Human Health Hazard - Low concern. Systemic toxicant (copper deficiency, pancreas). Ecological Hazard - Very toxic to aquatic life with long lasting effects. PBT Assessment: Does meet the screening criteria for toxicity.	Environmental Fate Properties: Biodegradability is not relevant because inorganic substance. PBT Assessment: Not applicable.	Environmental Fate Properties: Zinc is an essential metal that is found naturally in the environment. All living organisms have homeostasis mechanisms that actively regulate zinc uptake and absorption/excretion PBT Assessment: Does not meet the screening criteria for bioaccumulation.	**NICNAS:** Poses no unreasonable risk to human health based on Tier I assessment under the NICNAS IMAP assessment framework. **PBT Assessment:** The overall conclusion is that zinc oxide is not a PBT substance. Qualitative Assessment indicated potential hazard to human health (e.g., systemic toxicant). Zinc oxide is relatively insoluble which limits its bioavailability. However, there is a measurable rate of dissolution of zinc metal from zinc oxide. Zinc metal is highly toxicity to aquatic organisms. However, the potential exposure to aquatic receptors is considered incomplete (refer to text). **Management:** Safe Work Australia and Santos Occupational Safety Guidance will be used to minimise human health exposure. Implementation of Constraints Protocol in EMP will be required to prevent accidental discharge/release.

Table 2
Evaluation of Proposed Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Table Notes:

AICIS = Australian Industrial Chemicals Introduction Scheme
ANZECC = Australian and New Zealand Environment Conservation Council
BCF = bioconcentration factor
EC_{50} = effects concentration of half the maximal response
Kow = n-octanol-water partition coefficient
LC_{50} = lethal concentration of 50 percent of population
L/kg = litres per kilogram
mg/kg = milligram per kilogram
N/A = not applicable
NICNAS = National Industrial Chemicals Notification and Assessment Scheme
PBT = persistent, bioaccumulative, toxic
PNEC = predicted no effect concentration
WAF = Water Accommodated Fraction Analysis

1/ Refer to dossier for additional information

IMAP assessments available online at: https://services.industrialchemicals.gov.au/search-assessments/

Table 3
Existing Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical	CAS No.
2-Bromo-2-(bromomethyl)pentanedinitrile	35691-65-7
4-Vinylcyclohexene	100-40-3
Acrylamide, sodium acrylate polymer	25085-02-3
Acrylic acid polymer with sodium AMPS, sodium salt	37350-42-8
Aliphatic alcohol ethoxylate	9004-77-7
Alkenes, C15-C18	93762-80-2
Alkyl phenoxy ether sulfate, sodium salt	9014-90-8
Amylodextrin	9005-84-9
Barium Sulfate	7727-43-7
Bentonite	1302-78-9
Benzenesulfonic acid, dimethyl-, sodium salt	1300-72-7
Butadiene	106-99-0
Calcium chloride	10043-52-4
Calcium Chloride, dihydrate	10035-04-8
Calcium hydroxide	1305-62-0
Cellophane	9005-81-6
Choline chloride	67-48-1
Citric Acid	77-92-9
Crystalline silica, cristobalite	14464-46-1
Crystalline silica, quartz	14808-60-7
Crystalline silica, tridymite	15468-32-3
Dilutan Gum	125005-87-0
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues	68909-77-3
Ethoxylated branched C11-14, C13-rich alcohols	78330-21-9
FD&C Blue 1	3844-45-9
Ferrous Sulfate	17375-41-6
Functionalized Styrene Butadiene Latex	403824-26-0
Glutaraldehyde	111-30-8
Glyoxal	107-22-2
Heterocyclic polymer containing nitrogen compounds	9003-39-8
Humic acids, sodium salts, polymers with N,N-dimethyl-2-propenamide, sodium 2-methyl-2-[(1-oxo-2-propen-1-yl)amino]-1-propanesulfonate (1:1) and 2-propenenitrile, sodium bisulfite-terminated	473268-27-8
Hydrotreated light petroleum distillate	64742-47-8
Isopropanol	67-63-0
Lecithins	8002-43-5
Magnesium oxide	1309-48-4
Methanol	67-56-1
Methyloxirane polymer with oxirane, monbutyl ether	9038-95-3
Monoethanolamine	141-43-5
N,N-dimethylacrylamide copolymer with calcium AMPS	103115-52-2
Nitrilotriacetic acid, trisodium salt monohydrate	5064-31-3
Polypropylene glycol	25322-69-4
Portland cement	65997-15-1
Potassium chloride	7447-40-7
Potassium hydroxide	1310-58-3
Potassium pyrophosphate	7320-34-5
Silica, amorphous - fumed	7631-86-9
Silica, amorphous precipitated	67762-90-7
Silicic acid, potassium salt	1312-76-1
Soda Lime Borosilicate Glass	65997-17-3
Sodium acid pyrophosphate	7758-16-9
Sodium Carbonate	497-19-8

Table 3
Existing Drilling Fluid and Cementing Chemicals
Beetaloo McArthur Basin, Northern Territory Chemical Risk Assessment

Chemical	CAS No.
Sodium carboxymethyl cellulose	9004-32-4
Sodium Chloride	7647-14-5
Sodium erythorbate	6381-77-7
Sodium Hydroxide	1310-73-2
Sodium Lignosulfonate	8061-51-6
Sodium silicate	1344-09-8
Sodium sulfate	7757-82-6
Starch	9005-25-8
Starch, carboxymethyl ether	9057-06-1
Starch, carboxymethyl ether, sodium salt	9063-38-1
Strontium chloride	10476-85-4
Styrene	100-42-5
Sulfomethylated Quebracho	68201-64-9
Sulfurous acid, monosodium salt, polymer with formaldehyde and acetone	40104-76-5
Tartaric acid	87-69-4
Tetrahydro-3,5-dimethyl-1,3,5-thiadiazine-2-thione	533-74-4
Tetrakis(hydroxymethyl)phosphonium sulfate (THPS)	55566-30-8
Xanthan Gum	11138-66-2

Attachment A Risk Dossiers

Attachment A - Risk Dossiers
Dossier Cross-Reference

Chemical	CAS No.	Dossier Title
1,2-Benzisothiazolin-3-one	2634-33-5	BIT - Tiered.pdf
1,2-Diaminocyclohexane	694-83-7	1,2-Diaminocyclohexane - Standard.pdf
1,2-Ethanediamine, N-(2-aminoethyl)-	111-40-0	1,2-Ethanediamine, N-(2-aminoethyl)- - Standard.pdf
1-Methoxy-2-propanol	107-98-2	1-Methoxy-2-propanol-Standard.pdf
1-Propanesulfonic acid, 2-methyl-2-((1-oxo-2-propenyl)amino)-, monosodium salt, polymer with 2-propenamide	38193-60-1	Acrylamide polymers group - Standard.pdf
2,4,6 Tridimethylaminomethyl phenol	90-72-2	TMDA - Tiered.pdf
2-methoxy-1-propanol	1589-47-5	2-Methoxy-1-propanol - Standard.pdf
2-Methyl-4-isothiazolin-3-one	2682-20-4	CMIT MIT mixture - Tiered.pdf
2-methylbut-3-yn-2-ol	115-19-5	2-Methylbut-3-yn-2-ol - Standard.pdf
2-methylpropan-2-ol	75-65-0	2-Methylpropan-2-ol - Standard.pdf
2-Naphthalenesulfonic acid, polymer with formaldehyde, sodium salt	36290-04-7	Sodium polynapthalene sulfonate - Tiered.pdf
2-Propenenitrile, polymer with 1,3-butadiene	9003-18-3	Styrene Butadiene Latex group - Tiered.pdf
2-Propenoic acid, polymer with 1,3-butadiene and ethenylbenzene	25085-39-6	Styrene Butadiene Latex group - Tiered.pdf
2-Propenoic acid, sodium salt (1:1)	107097-75-6	Copolymer acrylamide and sodium acrylate - Tiered.pdf
3, 3'-Methylene bis (5-methyl oxazolidine)	66204-44-2	Oxazolidine - Tiered.pdf
3,6-diazaoctanethylenediamin	112-24-3	3,6-Diazaoctanethylenediamin - Standard.pdf
5-Chloro-2-methyl-3(2H)-isothiazolone mixture with 2-methyl-3(2H)-isothiazolone	55965-84-9	CMIT MIT mixture - Tiered.pdf
9-Octadecenamide, n,n-bis-2(hydroxy-ethyl)-,(Z)	93-83-4	Amides, tall oil fatty, N,N-bis(hydroxyethyl) - Tiered.pdf
9-Octadecenoic acid (9Z)-, monoester with 1,2,3-propanetriol	25496-72-4	9-Octadecenoic acid (9Z)-, monoester with 1,2,3-propanetriol and Monopropylene glycol monooleate - Standard.pdf
Acrylamide	79-06-1	2-Propenamid - Standard.pdf
Alcohol ethoxy sulfate, sodium salt	68585-34-2	Sodium lauryl polyoxyethylene ether sulphate - Tiered.pdf
Alcohols, C16-18, ethoxylated propoxylated	68002-96-0	Alcohol Alkoxylates Group - Tiered.pdf
Alcohols, C6-10, ethoxylated	70879-83-3	Alcohol Ethoxylates Group - Tiered.pdf
Aluminium stearate	637-12-7	Aluminum stearate - standard.pdf
Aluminum	7429-90-5	Aluminum - Standard.pdf
Aluminum oxide	1344-28-1	Aluminum oxide - Tiered.pdf
Ammonium chloride	12125-02-9	Ammonium chloride - Standard.pdf
ammonium hydrogensulphite	10192-30-0	Ammonium hydrogensulphite - Standard.pdf
Ammonium hydroxide	1336-21-6	Ammonia - Tiered.pdf
Ammonium sulfate	7783-20-2	Ammonium sulfate - Standard.pdf
ascorbic acid	50-81-7	Ascorbic acid - Standard.pdf
Benzene, 1,1'-oxybis-, tetratpropylene derivs., sulfonated, sodium salts	119345-04-9	Sodium Dodecyl Diphenyl Ether Disulfonate - Standard.pdf
Benzenemethanol	100-51-6	Benzyl alcohol - Standard.pdf
Bisphenol A / Epichlorohydrin resin	25068-38-6	Bisphenol A epichlorohydrin resin - Tiered.pdf
Boric acid	10043-35-3	Boric acid - Tiered.pdf
Butanedioic acid, 2-sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (1:1)	2373-38-8	Butanedioic Acid Group - Standard.pdf
Butanedioic acid, 2-sulfo-, 1,4-bis(2-methylpropyl) ester, sodium salt (1:1)	127-39-9	Butanedioic Acid Group - Standard.pdf
Butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt	577-11-7	Butanedioic Acid Group - Standard.pdf
Butyl glycidyl ether	2426-08-6	Butyl glycidyl ether - Tiered.pdf
Butylated hydroxytoluene	128-37-0	Butylated hydroxytoluene - Standard.pdf
C.I. Basic Violet 10 (Rhodamine B or D&C Red No 19)	81-88-9	CI Basic Violet 10 - Tiered.pdf
Calcined Petroleum coke	64743-05-1	Calcined petroleum coke - Tiered.pdf
Calcium aluminate	12042-68-1	Calcium aluminate and calcium aluminate cement - Tiered.pdf
Calcium aluminate cement	65997-16-2	Calcium aluminate and calcium aluminate cement - Tiered.pdf
Calcium carbonate	471-34-1	Calcium carbonate - Tiered.pdf
Calcium lignosulfonate	8061-52-7	Calcium lignosulfonate - Tiered.pdf
Calcium oxide	1305-78-8	Calcium oxide and Calcium hydroxide - Tiered.pdf
Calcium sulfate	7778-18-9	Calcium sulphate dihydrate - Tiered.pdf

Attachment A - Risk Dossiers
Dossier Cross-Reference

Chemical	CAS No.	Dossier Title
Calcium sulfate dihydrate	10101-41-4	Calcium sulphate dihydrate - Tiered.pdf
Calcium sulfate hemihydrate	10034-76-1	Calcium sulphate dihydrate - Tiered.pdf
Carbon	7440-44-0	Graphite - Tiered.pdf
Carbon black	1333-86-4	Graphite - Tiered.pdf
Cellulose	9004-34-6	Cellulose - Standard.pdf
Cyclohexanedimethanol diglydicyl ether	14228-73-0	Cyclohexanedimethanol diglydicyl ether.pdf
d-Glucopyranoside, C9-C11 alkyl oligomeric	132778-08-6	Alkyl polyglucosides - Tiered.pdf
Diatomaceous earth	61790-53-2	Crystalline silica and Mica - Standard.pdf
Diethylene glycol monoethyl ether	111-90-0	DGME - Tiered.pdf
Diethyltoluenediamine	68479-98-1	Diethyltoluenediamine - Tiered.pdf
Dimethyl polysiloxane	63148-62-9	Siloxanes and Silica - Standard.pdf
Dimethylaminopropylamine	109-55-7	Dimethylaminopropylamine - Standard.pdf
Dipropylene glycol	25265-71-8	Dipropylene glycol - Standard.pdf
Epichlorohydrin	106-89-8	Epichlorohydrin - Standard.pdf
Ethanol, 2-amino-, compounds with polyethylene glycol hydrogen sulfate C6-10-alkyl ether	70914-35-1	Aliphatic alcohol ethoxylate - Tiered.pdf
Ethylenediaminetetraacetic acid, tetrasodium salt	64-02-8	Ethylene diaminetetraacetic acid tetrasodium salt (Na4EDTA) - Standard.pdf
Fatty acids, C14-18 and C16-18-unsatd.	67701-06-8	Fatty acids, C14-18 and C16-18-unsaturated - Standard.pdf
Fatty acids, C8-18 and C18-unsatd., esters with pentaerythritol	85049-33-8	Fatty acids, C8-18 and C18-unsatd.pdf
Fly ash	68131-74-8	Aluminum oxide - Tiered.pdf
Glycine, n,n-{bis{2-bis(carboxymethyl)amino}ethyl}-, pentasodium salt	140-01-2	Pentasodium diethylenetriamine pentaacetate - Standard.pdf
Granulated Blast Furnace Slag	65996-69-2	Aluminum oxide - Tiered.pdf
Gypsum	13397-24-5	Calcium sulphate dihydrate - Tiered.pdf
Hexamethylenediamine	124-09-4	Hexamethylenediamine - Tiered.pdf
Hexylene glycol	107-41-5	Hexylene glycol - Standard.pdf
Humic acids, potassium salts, polymers with acrylamide, 2-methyl-2-[(1-oxo-2-propenyl)amino]-1-propanesulfonic acid, 4-(1-oxo-2-propenyl) morpholine and sodium 4- ethenylbenzenesulfonate, sodium salts	227951-37-3	Anionic polyacrylamide - Tiered.pdf
Hydroxyethyl cellulose	9004-62-0	Sodium carboxymethylcellulose - Tiered.pdf
Iron oxide	1309-37-1	Iron oxide - Tiered.pdf
Kaolin	1332-58-7	Ceramic Materials and Wares - Tiered.pdf
Limestone	1317-65-3	Calcium carbonate - Tiered.pdf
Magnesium chloride hexahydrate	7791-18-6	Magnesium chloride - Tiered.pdf
Metaphosphoric acid hexasodium salt	10124-56-8	Sodium Metaphosphate - Standard.pdf
Mica-group minerals	12001-26-2	Crystalline silica and Mica - Standard.pdf
Monopropylene glycol monooleate	1330-80-9	9-Octadecenoic acid (9Z)-, monoester with 1,2,3-propanetriol and Monopropylene glycol monooleate - Standard.pdf
Natural graphite	7782-42-5	Graphite - Tiered.pdf
Paraffin based petroleum oil	8012-95-1	Paraffin Based Petroleum Oils - Tiered.pdf
Paraffins, petroleum, normal C5-20	64771-72-8	Parraffins - Standard.pdf
Poly(oxy-1,2-ethandiyl), a-(nonylphenyl)-w-hydroxy-	9016-45-9	Polyoxyethylene nonylphenol ether - Tiered.pdf
Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(dodecyloxy)-, ammonium salt	32612-48-9	Sodium lauryl polyoxyethylene ether sulphate - Tiered.pdf
Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(tetradecyloxy)-, ammonium salt	27731-61-9	Sodium lauryl polyoxyethylene ether sulphate - Tiered.pdf
Poly(vinyl acetate)-poly(vinyl alcohol) polymer	25213-24-5	Poly(vinyl acetate)-poly(vinyl alcohol) polymer - Tiered.pdf
Poly[oxy(methyl-1,2-ethanediyl)], α-(2-aminomethylethyl)-ω-(2-aminomethylethoxy)-	9046-10-0	Polyether amine - Tiered.pdf
Polyethylene	9002-88-4	Polyethylene - Tiered.pdf
Polyethylene glycol (C6-C10) alkyl ether, sulfate ammonium salt	68037-05-8	Sodium lauryl polyoxyethylene ether sulphate - Tiered.pdf
Polyethylene terephthalate	25038-59-9	Polyethylene terephthalate - Standard.pdf
Polyoxyethylene sorbitan trioleate	9005-70-3	Sorbitan Group - Standard.pdf
Polyproplylene and polyethylene oxide copolymer	9003-11-6	EO-PO copolymer - Tiered.pdf
Polypropylene	9003-07-0	Polypropylene glycol - Tiered.pdf

Attachment A - Risk Dossiers
Dossier Cross-Reference

Chemical	CAS No.	Dossier Title
Polypropylene glycol monododecyl ether	9002-92-0	Alcohol Ethoxylates Group - Tiered.pdf
Polyvinyl alcohol	9002-89-5	Polyvinylalcohol - Tiered.pdf
Propanesulfonic acid, 2-methyl-2-[(1-oxo-2-propenyl)amino]-, monosodium salt, polymer with N,N-dimethyl-2-propenamide	92815-96-8	Copolymer acrylamide and sodium acrylate - Tiered.pdf
Pumice	1332-09-8	Sodium Silicate and Pumice - Standard.pdf
Quaternary ammonium compounds, bis(hydrogenated tallow alkyl) dimethyl,salts with bentonite	68953-58-2	Quaternary ammonium compounds - Standard.pdf
Quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with attapulgite	68953-57-1	Quaternary ammonium compounds - Standard.pdf
Quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides	92129-33-4	Quaternary Ammonium Compounds C16C18ADC-Standard.pdf
Rape Oil	8002-13-9	Rape Oil - Tiered.pdf
Sepiolite	63800-37-3	Magnesium silicate hydrate (Talc) - Standard.pdf
Silane, dichlorodimethyl-, reaction products with silica	68611-44-9	Siloxanes and Silica - Standard.pdf
Silicic acid, lithium magnesium sodium salt	53320-86-8	Silicic acid potassium salt - Tiered.pdf
Sodium aluminate	1302-42-7	Sodium aluminate - Tiered.pdf
Sodium dicyclohexyl sulfosuccinate	23386-52-9	Sodium dicyclohexyl sulfosuccinate - Standard.pdf
Sodium fluoroescein	518-47-8	Sodium fluoroescein - Standard.pdf
Sodium Formate	141-53-7	Sodium formate - Tiered.pdf
Sodium gluconate	527-07-1	Sodium gluconate - Tiered.pdf
Sodium lauryl ether sulfate	9004-82-4	Sodium lauryl polyoxyethylene ether sulphate - Tiered.pdf
Sodium nitrate	7631-99-4	Sodium nitrate - Tiered.pdf
Sodium polyphosphate	68915-31-1	Sodium acid pyrophosphate - Tiered.pdf
Sodium salt of sulfonated naphthaleneformaldehyde condensate	9084-06-4	Sodium polynapthalene sulfonate - Tiered.pdf
Sorbitan, monopalmitate	26266-57-9	Sorbitan Group - Standard.pdf
Sorbitan, tri,(9Z)-9-octadecenoate	26266-58-0	Sorbitan Group - Standard.pdf
Styrene / 1,3 Butadiene copolymer	9003-55-8	Styrene Butadiene Latex group - Tiered.pdf
Sulfonated organic polymer	526203-62-3	Sodium polynapthalene sulfonate - Tiered.pdf
Triazine	290-87-9	Triazine - Standard.pdf
Triazinetriethanol	4719-04-4	Triazinetriethanol - Tiered.pdf
Walnut, Juglans regia, ext	84012-43-1	Walnut hulls etc - Tiered.pdf
Welan gum	72121-88-1	Diutan and Welan Gum - Tiered.pdf
Zinc oxide	1314-13-2	Zinc oxide - Standard.pdf

1,2-DIAMINOCYCLOHEXANE

This dossier on 1,2-diaminocyclohexane presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): Cyclohexane-1,2-diamine

CAS RN: 694-83-7

Molecular formula: $C_6H_{14}N_2$

Molecular weight: 114.189 g/mol

Synonyms: 1,2-cyclohexanediamine; DCH; (1S,2S)-cyclohexane-1,2-diamine

SMILES: NC1CCCCC1N

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of 1,2-diaminocyclohexane

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Clear liquid with amine-like odour	1	ECHA
Melting Point	3.3°C @ 101.3 kPa	1	ECHA
Boiling Point	191.4°C @ 101.3 kPa	2	ECHA
Density	9,490 kg/m^3@ 23.3°C	1	ECHA
Vapour Pressure	51.6 Pa @ 20°C	2	ECHA
Partition Coefficient (log K_{ow})	0 @ 20°C	1	ECHA
Water Solubility	900 g/L @ 23.5°C	2	ECHA
Flash Point	70°C	1	ECHA
Auto flammability	340°C	1	ECHA
Viscosity	7.7 mPa s @ 23°C	1	ECHA
Henry's Law Constant	Not available	-	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

1,2-Diaminocyclohexane is readily biodegradable and is not expected to bioaccumulate. It is likely to strongly adsorb to soils, suspended solids and sediment.

B. Biodegradation

The biochemical degradability of 1,2-diaminocyclohexane at 20 deg C was determined according to the OECD-Guideline No. 301 D. The test item was found to be readily biodegradable, fulfilling the 10 -day window requirement (101% within 21 days). (ECHA) [KI. Score = 1].

If a chemical is found to be readily or inherently biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

Aliphatic amines, such as 1,2-diaminocyclohexane, are strong bases and are protonated at environmental pH and, in consequence, due to the positive charge are prone to bind on negatively charged solid matter. This was demonstrated in a Batch Equilibrium test (according to OECD 106, compliant to GLP; 2013) performed using four soil types: Speyer 2.1 (soil I, sand), Speyer 6S (soil II, clay), Empingham (soil III, clay loam) and Mechtildshausen (soil IV, loam). Average soil organic carbon partition coefficient (K_{oc}) values were derived from measured K_d values using a fraction of organic carbon value of 2%. An average log K_{oc} value of 4.23 L/Kg (K_{oc} of 16,982 L/Kg) was reported (ECHA). [KI. Score =1].

Based upon this K_{oc} value, if released to soil, 1,2-diaminocyclohexane is expected to strongly adsorb to soil and have no potential for mobility. If released to water, based on its K_{oc} value and tendency to bind on negatively charged solid matter, 1,2-diaminocyclohexane is likely to also strongly adsorb to suspended solids and sediment.

D. Bioaccumulation

Based on the log K_{ow} (0) and a low potential to cross biological membranes, bioaccumulation is not to be expected. Due to the high primary and moderate secondary pKa-values, 1,2-diaminocyclohexane will be present in the aqueous environment exclusively as a mono-cation (whole pH range) to di-cation (dependant on pH and molecular micro-environment). Regarding partitioning between n-octanol and water, this results in a clear partitioning into the water phase, excluding any partitioning based bioaccumulation. At the same time, two vicinal positive charges and a short C6 backbone implies a very low potential to cross biological membranes (ECHA).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

1,2-Diaminocyclohexane is a moderate acute oral and inhalation toxicant with acute dermal toxicity potential. This material is corrosive to both the skin and eyes and caused weak skin sensitising effects. 1,2-Diaminocyclohexane has the potential to effect the male reproductive system without marked systemic toxicity in repeated-dose oral toxicity studies. No adverse effects were observed in developmental toxicity studies. This material exhibited genotoxicity both in vitro and in vivo. No studies on carcinogenicity were available.

B. Metabolism

There are no reliable data available

C. Acute Toxicity

Oral

In a study similar to OECD guideline 401, 1,2-diaminocyclohexane was administered via oral gavage to 5 male and 5 female Wistar rats per dose group (681, 1000, 1470 and 2150 mg/kg bw). Clinical signs included dyspnoea, apathy and poor general health. The LD 50 value was calculated to be 1170 mg/kg bw (ECHA). [Kl. Score=1]

Inhalation

In an acute inhalation toxicity study (OECD 403), male rats (10 animals) were exposed nose-only to an aerosolized / vapor mixture of 3.2 mg/L 1,2-diaminocyclohexane for 4 hrs. There was one death in this study. Under the conditions of this test, the 4-hour LC50 could not be determined, however the approximate lethal concentration of 98% 1,2-diaminocyclohexane was determined to be 3.2 mg/L. No deaths occurred in any of the exposures using either the 89% or the 93% 1,2-diaminocyclohexane formulations. This material is considered to be low to moderate in toxicity on an acute Inhalation basis in rats (ECHA). [Kl. Score=2]

Dermal

In study similar to OECD guideline 402, 1,2-diaminocyclohexane was administered under occlusive conditions for 24 h to the skin of 5 male and 5 female Sprague-Dawley rats per dose group (1000, 1600, 2000, 2500 and 3200 mg/kg bw). There were no deaths in the 1000 mg/kg bw group. At 1600 mg/kg bw, one female rat died and 3 males and 4 females died in the 2000 mg/kg bw group. All animals died in the 2500 and 3200 mg/kg bw group. The LD50 value was calculated to be 1870 mg/kg bw (ECHA). [Kl. Score=1]

D. Irritation

Skin

A skin irritation/corrosion test was performed according to OECD 404 with six rabbits. The animals were exposed to 0.5 ml of 1,2-diaminocyclohexane on the clipped skin under semiocclusive conditions for 3 minutes or 1 h. The skin reactions were observed for 72 h after the initial exposure. All six animals showed severe skin corrosion. Under the applied test conditions 1,2-diaminocyclohexane induced skin corrosion in all animals (ECHA). [Kl. Score=1]

Eye

An eye irritation/corrosion test was performed with six rabbits according to an FDA guideline. The animals were exposed to 0.1 ml of test substance. Strong corrosive effects were observed in all animals. Under the conditions of the test the test substance is corrosive to the rabbit eye (ECHA). [Kl. Score=1]

E. Sensitisation

Skin

In an intracutaneous guinea pig test, 5 male and 5 female guinea pigs were treated with two concentrations of 1,2-diaminocyclohexane each (10 % or 1 %). After 2 days, the induction phase consisted of 4 intradermal injections with 0.1 ml of 1% (v/v) emulsion with 1 injection per week. Additional animals were used as negative and positive control animals. The challenge phase started two weeks after last induction injection. The 10 % group showed very slight to moderate erythema in the 24 and 48 h reading (8/9 and 8/9 animals). In the corresponding negative control group 3/5 animals showed slight erythema in the 24 and 48 h reading, revealing the irritant potential of the test substance at this concentration level. In the 1 % test group no effects were observed. Due to these observed results, a rechallenge was performed. At 48 hrs. after the rechallenge with 10% of cyclohexane-1,2-diamine, 6/9 animals showed slight or mild erythema, whereas none of the negative control animals showed skin response. In the 1 % test group and negative control group no effects were observed. Under the applied test conditions, results of this skin sensitisation assay with guinea pigs are ambiguous, as corrosiveness of the substance complicated interpretation of results. A rechallenge exposure therefore was needed. According to this study, the test substance reveals weak skin sensitising effects taken the results from the rechallenge exposure (ECHA). [Kl. Score=2]

F. Repeated Dose Toxicity

Oral

A Repeated Dose 90-day Oral Toxicity Study was conducted in accordance with OECD 408 guidelines. Wistar rats (10 animals per sex per dose) were exposed to 50, 150, or 500 mg/kg bw/day 1,2-diaminocyclohexane daily by oral gavage for 13 weeks. During the study, clinical condition, detailed physical examination and arena observations, sensory reactivity observations, grip strength, motor activity, body weight, food consumption, water consumption, ophthalmic examination, hematology (peripheral blood), blood chemistry, urinalysis, thyroid hormone, oestrous cycles, organ weight, sperm analysis, macropathology and histopathology investigations were undertaken. In this study, doses of 50, 150 or 500 mg/kg/day were tolerated, though there was the development of a non-specific toxic response in males. The hemolymphoreticular system and male reproductive system were the targets of toxicity and there were findings in this study that were indicative of an effect on liver and kidney function. These effects were associated with reduced sperm count, motility and increased numbers of abnormal sperm in males receiving 500 mg/kg/day and epididymal vacuolation, associated with reduced epididymal sperm count in males receiving 150 mg/kg/day. Adverse findings were reported in the hemolymphoreticular system (spleen, lymph nodes and Peyer's patches) of both sexes receiving 500 mg/kg/day. Non-adverse findings included evidence of adaptive responses by the liver and kidney in both sexes receiving 150 or 500 mg/kg/day and variations to some organ weights (heart, thymus gland and ovaries) without histopathological correlate. In view of these findings, the no-observed-adverse-effect level (NOAEL) in this study was 50 mg/kg/day in males and 150 mg/kg/day in females (ECHA). [Kl. Score=1]

Inhalation

In a subacute inhalation toxicity study, male rats were exposed nose-only to an aerosolized/vapour mixture consisting of cyclohexane-1,2-diamine. Exposure was 6 hours per day, 5 days per week for two weeks followed by a 14-day recovery period. Concentrations used were 0, 10, 49 and 240 mg/m³ (analytical). The effects observed in rats exposed to 1,2-diaminocyclohexane ranged from severe (including death) in the 250 mg/m³ group to minimal in the 9.2 mg/m³ group. The body weights of the rats in the 250 mg/m³m³ group were significantly lower than those of the control rats during the exposure period and in the first week of the recovery period. Lung weights were

increased in this group immediately after the 2-week exposure period and after the 2-week recovery period. Clinical laboratory results for rats in the 250 mg/m³m³ suggested the presence of dehydration/haemoconcentration indicated by increases in relative numbers of red blood cells, in haemoglobin concentration, and in haematocrit percentage, and by decreases in urine volume and increases in urine osmolality. Cross examination at necropsy showed multifocal areas of discoloration present in the lungs of the rats exposed to 250 mg/m³ immediately after the 2-week exposure and 2 weeks later. Microscopically, exposure-related lesions were confined to the respiratory tract and were dose related. In the 59 and 250 mg/m³ groups, lesions were observed in the nose, trachea, larynx/pharynx, and lung. These lesions were mainly minimal to mild in the 50 mg/m³ group and mild to moderate in the 250 mg/m³ group. Nasal lesions consisted of inflammation, necrosis, regeneration, and squamous metaplasia of the olfactory and respiratory epithelium; laryngeal/pharyngeal lesions consisted of subacute inflammation; tracheal lesions observed were hyperplasia, hypertrophy, and necrosis of the respiratory epithelium; pulmonary lesions consisted of hypertrophy and hyperplasia of bronchial and bronchiolar epithelium. After the 2 -week recovery period, the above nasal and pulmonary lesions were diminished in severity and the tracheal and laryngeal/pharyngeal lesions were no longer present. Since the effects on the respiratory tract were observed at all concentrations and that the effects were dose related, a NOAEL could not be determined. The lowest observed adverse effect concentration (LOAEC) of this study was established to be 10 mg/m³ (ECHA). [Kl. Score=2]

Dermal

No data available

G. Genotoxicity

In vitro data for 1,2-diaminocyclohexane indicate that this substance has potential to induce gene mutations in bacteria but not in mammalian cells. Furthermore, no cytogenic (i.e. chromosomal) aberrations were observed in mammalian cells. In an *in vivo* Mammalian Alkaline Comet Assay (OECD TG 489), the substance did induce DNA strand breaks in liver cells of male rats, but not in stomach and duodenum. Additional testing has been recommended in ECHA.

In Vitro Studies

The *in vitro* genotoxicity studies on 1,2-diaminocyclohexane are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on 1,2-diaminocyclohexane

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial Reverse Mutation Assay (OECD 471)	+	-	1	ECHA
Mammalian Cell Gene Mutation Test (OECD 490)	-	-	1	ECHA
Mammalian Chromosome Aberration Test (OECD 473)	-	-	1	ECHA

*+, positive; -, negative

In Vivo Studies

1,2-Diaminocyclohexane was tested in the Comet assay (OECD 498) for its potential to induce DNA strand breaks (measured as percent tail intensity (%TI)) in the liver, glandular stomach and duodenum of male Han Wistar rats. Animals were exposed to 500, 1000, or 2000 mg/kg bw/day of the test material by oral gavage. The duration of treatment was 24 hr and was observed for signs of toxicity. It is concluded that, under the conditions of this Comet assay, 1,2-diaminocyclohexane did not induce DNA strand breaks in the stomach and duodenum of rats treated up to 2000 mg/kg/day (the maximum recommended dose for in vivo Comet studies). It is concluded that, under the conditions of this Comet assay1,2-diaminocyclohexane induced DNA strand breaks in the liver of rats treated up to 2000 mg/kg/day (the maximum recommended dose for in vivo Comet studies) (ECHA). [Kl. Score=1]

H. Carcinogenicity

Oral

No data available

Inhalation

No data available

Dermal

No data available

I. Reproductive Toxicity

A Combined Reproduction / Developmental Toxicity Study was conducted in accordance with OECD 422 guidance. 1,2-Diaminocyclohexane was administered by daily oral gavage to male and female Wistar rats at dose levels of 0, 50, 150 and 500 mg/kg/day. The males were exposed for 2 weeks prior to mating, during mating, and up to termination (for 31 days). The females were exposed for 2 weeks prior to mating, during mating, during post-coitum, and at least 3 days of lactation (for 42 to 45 days). No treatment related mortality occurred during the study period.

At 500 mg/kg, all treated males and females showed slight to moderate salivation. Two males at this dose also showed incidental rales, and one female showed piloerection at the end of treatment. Body weight gain was reduced at 500 mg/kg in males during treatment and in females on post-coitum Days 14–20 and during lactation, although these changes were not always statistically significant. Food consumption, with and without adjustment for body weight, was also reduced during lactation in females at 500 mg/kg, but the change was not statistically significant. Motor activity increased at the low sensor in females at 500 mg/kg, possibly due to hyperactivity of the dams and/or pups. In both sexes, 500 mg/kg caused a treatment-related decrease in eosinophils. Clinical biochemistry changes, mainly in males, included increased alanine aminotransferase, aspartate aminotransferase (also increased in females at 500 mg/kg), alkaline phosphatase, and cholesterol. Cholesterol was also increased in males at 150 mg/kg, but to a lesser extent. At 500 mg/kg, these findings correlated with macroscopic and microscopic liver effects, including pale discolouration, increased liver-to-body weight ratios, and minimal to slight hepatocellular vacuolation. Calcium levels were also increased in males and females at this dose. Minor treatment-related morphological changes were observed in the lungs and adrenal glands. In the lungs, alveolar macrophage foci increased in incidence and reached moderate severity in females at 500 mg/kg. In

the adrenal glands of males, vacuolation in the zona fasciculata showed a slight, non-statistically significant increase in incidence at 500 mg/kg, although a positive trend was noted. Overall, the liver, lung, and adrenal findings were minor and may reflect slight increases in spontaneous lesions or adaptive responses; accordingly, they were considered indicators of slight toxicity. Changes in thymus and kidney weights were supported by corresponding microscopic findings, including atrophy and basophilia, respectively. No supporting findings were observed for changes in the weights of the heart, epididymides, or brain.

The gestation index was decreased in females at 500 mg/kg. No effect was noted at the duration of gestation and precoital time at 50, 150 or 500 mg/kg. Of all animals, three females did not mate (one in the control group, one in the low dose group and one in the high dose group) and two females had implantations sites only (high dose group). In males suspected of infertility, there were no findings in the reproductive organs of any of the animals which would account for poor reproductive performance. Further, the spermatogenic staging profiles were normal for all Group 1 and Group 4 males evaluated. In females suspected of infertility, animal 75 (group 4) had endometrial inflammation. Animals 73 and 77 (group 4) had vaginal epithelial mucification (possible oestrus cycle disturbance). At 500 mg/kg, the average and total number of living pups per litter was reduced at the first litter check, (average of 6.9 pups per litter) when compared to concurrent controls (average of 16.0 pups per litter). An increased incidence in postnatal loss (due to increased cannibalism) was noted at 50, 150 and 500 mg/kg, resulting in a reduced viability index. No dose response relationship could be established between the treated groups. There was an increased incidence in missing and cannibalized pups, correlating with the increased post-natal loss noted at 50, 150 and 500 mg/kg when compared to the concurrent controls. In surviving pups, no treatment related changes in developmental indices were noted. Furthermore, (mean) body weights were similar for the control and treated groups. In conclusion, treatment with test material by oral gavage in male and female Wistar rats at dose levels of 0, 50, 150 and 500 mg/kg/day revealed clear parental and reproduction toxicity at 500 mg/kg body weight/day. At the same dose level there was a significant difference in number of living pups at the first litter check compared to controls. Overall, the NOAEL for parental and reproduction/developmental toxicity was 150 mg/kg bw/day (ECHA). [Kl. Score=1]

J. Developmental Toxicity

Oral

Details of the developmental toxicity studies are above. Based on the results of this study, the NOAEL for maternal toxicity and embryo-fetal survival and development was concluded to be 150 mg/kg/day (with developmental effects only being present at maternal toxic doses). (ECHA). [Kl. Score=1]

Inhalation

No data available

Dermal

No data available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for 1,2-diaminocyclohexane follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

The lowest NOAEL from these studies is 50 mg/kg bw/day based on adverse effects on male reproductive system obtained from a subchronic (90-day) repeated dose toxicity study conducted in rats. The NOAEL of 50 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 50/(10 x 10 x 1 x 10 x 1) = 5/1000 = 0.05 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.05 x 70 x 0.1)/2 = 0.18 mg/L

B. Cancer

There was no data available for the carcinogenic potential of 1,2-diaminocyclohexane. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

1,2-Diaminocyclohexane does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

1,2-Diaminocyclohexane is expected to have low acute and chronic toxicity to aquatic organisms. While studies on the terrestrial toxicity of 1,2-diaminocyclohexane are not available, read-across studies with 1,6-hexane diamine (CAS RN 124-09-4) suggests a low terrestrial toxicity for 1,2-diaminocyclohexane.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on 1,2-diaminocyclohexane.

Table 3: Acute Aquatic Toxicity Studies on 1,2-Diaminocyclohexane

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Pimephales promelas (Fathead minnow fish)	96-hr LC_{50}	1,825	2	ECHA
Raphidocelis subcapitata (Green alga)	72-hr EC_{50}	76 (growth)	1	ECHA

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on 1,2-diaminocyclohexane.

Table 4: Chronic Aquatic Toxicity Studies on 1,2-Diaminocyclohexane

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Pimephales promelas (Fathead minnow fish)	96-hr NOEC	1,000	2	ECHA
Daphnia magna (Water flea)	21-day NOEC	10	1	ECHA
Raphidocelis subcapitata (Green alga)	72-hr EC_{10}	35 (growth)	1	ECHA

C. Terrestrial Toxicity

In a 56-day study with *Eisenia fetida* (earthworms) in artificial soil with 10 percent peat, read-across substance 1,6-hexane diamine was applied in concentrations of 62.5, 125, 250, 500, and 1,000 milligram per kilogram dry weight (mg/kg dw). The study identified an acute 56-day EC10 of 176.1 mg/kg dw based on reproduction and chronic NOECs of 125 mg/kg dw (56 days, reproduction) and 250 mg/kg dw (28 days, mortality) (ECHA) [KI. score = 1].

In a 28-day study for the effects on microorganisms in Lucerne-amended natural soil, read-across substance 1,6-hexane diamine was applied in concentrations of 0, 62.5, 125, 250, 500, and 1,000 mg/kg dw. The study identified a chronic NOEC of 1,000 mg/kg dw based on nitrate formation rate (ECHA) [KI. score = 1].

D. Calculation of PNEC

The PNEC calculations for 1,2-diaminocyclohexane follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (1,825) and algae (76 mg/L). NOEC values from long-term studies are available for fish (1,000 mg/L), invertebrates (10 mg/L) and algae (35 mg/L). On the basis that the data consists of short-term results from two trophic levels and long-term results from three trophic levels, an assessment factor of 50 has been applied to the lowest reported NOEC of 10 mg/L for invertebrates. The $PNEC_{water}$ is 0.2 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 51 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (327/1280) \times 1000 \times 0.2$
$= 51$ mg/kg

Where:

$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 679/1000 \times 2400]$
$= 327\ m^3/m^3$

Where:

Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
$= 16,982 \times 0.04$
$= 679$ L/kg

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The average K_{oc} for 1,2-diaminocyclohexane calculated from K_d in accordance with ECHA guidance document R.16 is 16,982 L/kg (ECHA).
F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are no toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ 45 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
= (340/1500) x 1000 x 0.2
= 45 mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
$Kp_{soil} = K_{oc} \times f_{oc}$
= 16,982 x 0.02
= 340 m^3/m^3

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The average K_{oc} for 1,2-diaminocyclohexane calculated from K_d in accordance with ECHA guidance document R.16 is 16,982 L/kg (ECHA).
F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

1,2-Diaminocyclohexane is readily biodegradable and thus does not meet the screening criteria for persistence.

Based on the log K_{ow} (0) and a low potential to cross biological membranes, bioaccumulation is not to be expected. Thus, 1,2-diaminocyclohexane does not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on 1,2-diaminocyclohexane are > 0.1 mg/L. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies on 1,2-diaminocyclohexane are > 1 mg/L. Thus, 1,2-diaminocyclohexane does not meet the criteria for toxicity.

The overall conclusion is that 1,2-diaminocyclohexane is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Mutagen Category 2

Reproductive Toxin Category 1B

Acute Toxicity Category 4 (Dermal)

Acute Toxicity Category 4 (Oral)

Specific Target Organ Toxicity – Single Exposure Category 3

Skin Corrosion Category 1A

Eye Damage Category 1

B. Labelling

Danger

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention immediately.

Skin Contact

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately.

Inhalation

Move to fresh air. Supply oxygen or artificial respiration if needed. Do not use mouth-to-mouth method if victim inhaled the substance. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Get medical attention.

Ingestion

If material is ingested, immediately contact a physician or poison control centre. Have victim rinse mouth thoroughly with water. Never give anything by mouth to a victim who is unconscious or is having convulsions. Do not induce vomiting without medical advice. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Get medical attention.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Decomposition of this product may emit oxides of nitrogen and carbon monoxide.

Special Protective Equipment for Firefighters

Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, and face mask.

C. Accidental Release Measures

Personal Precautions

For non-emergency personnel Avoid contact with spilled material. For emergency responders Keep unnecessary personnel away. Ventilate closed spaces before entering. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Remove all sources of ignition. Stay upwind.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Extinguish all flames in the vicinity. Should not be released into the environment. Prevent entry into waterways, sewers, basements or confined areas. Dike far ahead of liquid spill for later disposal. Move the cylinder to a safe and open area if the leak is irreparable. Large Spills: Stop the flow of material, if this is without risk. Move the cylinder to a safe and open area if the leak is irreparable. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Never return spills to original containers for re-use. Clean up in accordance with all applicable regulations. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean contaminated surface thoroughly.

D. Storage And Handling

General Handling

Do not breathe gas/fumes/vapour/spray. Avoid contact with skin and eyes. Do not empty into drains. Follow all SDS/label precautions even after container is emptied because they may retain product residues.

Storage

Protect from moisture. Use care in handling/storage. Keep in a well-ventilated place. Store in a closed container away from incompatible materials. Keep away from heat and sources of ignition. Keep container tightly closed. Keep the container dry. Keep this material away from food, drink and animal feed.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard for 1,2-diaminocyclohexane has not been established in Australia.

Engineering Controls

Avoid exposure - obtain special instructions before use. Good ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. Individual protection measures, such as personal protective equipment.

Personal Protection Equipment

Respiratory Protection: Wear positive pressure self-contained breathing apparatus (SCBA). When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Hand Protection:

Protective gloves. Solvent-resistant gloves (butylrubber). Permeation rate: >480 min Thickness: >0.7 mm..

Skin Protection: Wear suitable protective clothing.

Eye protection: Safety glasses with side-shields.

F. Transport Information

Australian Dangerous Goods

UN 2735, AMINES, LIQUID, CORROSIVE, N.O.S. (1,2-DIAMINOCYCLOHEXANE)

Class 8

Packing Group III

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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1,2-ETHANEDIAMINE, N-(2-AMINOETHYL)-

This dossier on 1,2-ethanediamine, N-(2-aminoethyl)- (also referred to as diethylenetriamine or DETA) presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): bis(2-aminoethyl)amine

CAS RN: 111-40-0

Molecular formula: $C_4H_{13}N_3$

Molecular weight: 103.166 g/mol

Synonyms: Diethylenetriamine; 2,2'-diaminodiethylamin; DETA; 2,2'-iminodi(ethylamine)

SMILES: NCCNCCN

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of Diethylenetriamine

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Clear to slightly yellow liquid	2	ECHA
Melting Point	-39 °C°C @ 101.3 kPa	2	ECHA
Boiling Point	207°C @ 101.3 kPa	2	ECHA
Density	958.6 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	21.3 Pa @ 20°C	2	ECHA
Partition Coefficient (log K_{ow})	-1.58 @ 20°C	2	ECHA
Water Solubility	1,000 g/L @ 20°C	2	ECHA
Flash Point	96.7°C	1	ECHA
Auto flammability	358°C	2	ECHA
Viscosity	5.05 mPa s @ 20°C	2	ECHA
Henry's Law Constant	1 x 10^{-9} Pa-m^3/mol (temperature not provided)	-	NCBI, 2026

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Diethylenetriamine is readily biodegradable and has a low potential for bioaccumulation. It has a high potential to adsorb soil or sediment.

B. Biodegradation

Diethylenetriamine is readily biodegradable. In an OECD Guideline 301 D (Ready Biodegradability: Closed Bottle Test) study, 87% biodegradation was determined after 21 days (ECHA). [Kl. Score = 2].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

Despite its moderate/ high vapor pressure (21.3 Pa at 20 °C), diethylenetriamine is expected to be essentially non-volatile from water due to its miscibility in water and occurrence as a cationic (multi-protonated) species under pH conditions occurring in the environment (ECHA).

In experimental studies conducted on six different soil types, an average soil organic carbon partition coefficient (K_{oc}) of 19,111 L/Kg was measured (ECHA). [Kl. Score = 1]. Based on this K_{oc} value, if released to soil, the substance is expected to strongly adsorb to soil and have limited to no mobility. If released to water, based on its K_{oc} value and water solubility, diethylenetriamine is expected to strongly adsorb to suspended solids and sediments.

D. Bioaccumulation

In experimental studies, diethylenetriamine was determined to exhibit very low bioconcentration in freshwater fish (*Cyprinus carpio*). The measured BCF values ranging from < 0.3 to 6.3 are consistent with such a substance having miscibility in water, low log Kow (-1.58), and carrying ionic charge(s) under pH conditions encountered in the aquatic environment. The substance is therefore of very low concern for bioaccumulation in aquatic organisms (ECHA). [Kl. Score = 2].

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

The metabolism, disposition and pharmacokinetics of diethylenetriamine in rats was studied. Feces and urine were the primary routes of excretion. Diethylenetriamine was a moderately acute oral, inhalation, and dermal toxicant. This material is necrotic to the skin and corrosive to the eye. Diethylenetriamine had skin sensitisation potential; however, it lacks the potential for respiratory sensitisation. Repeat-dose studies through oral, inhalation, or dermal exposure demonstrated that the substance has the potential to cause systemic toxicity, and reproductive / developmental toxicity. Diethylenetriamine is not genotoxic or carcinogenic.

B. Metabolism

The metabolism, disposition and pharmacokinetics of diethylenetriamine in rats was studied. The route of administration, oral or endotracheal, had little effect on the distribution within the body or the elimination of radioactivity from the rat. Feces and urine were the primary routes of excretion with less than 2% of the administered dose expired as 14CO2. More than 96% of the recovered dose

was eliminated within 48 hours after dosing. In comparing results from animals receiving 500 mg per kg versus 50 mg per kg, there was a significant increase in the percentage of radioactivity excreted in the urine and a significant decrease in that eliminated at 14 CO_2 at the higher dosage level. The route of dose administered did not affect the following pharmacokinetic parameters at the 50 mg/kg level: bioavailability, total clearance or terminal half-life (ECHA). [Kl. Score=2]

C. Acute Toxicity

Oral

The acute oral toxicity of diethylenetriamine was examined in rats. Male Wistar rats were given 1, 2, or 4 ml/kg of DETA and observed for 14 days for signs of toxicity. All animals died at 4 mL/kg, while 4/5 died at 2 mL/kg. There were no deaths at the low dose. The acute oral LD50 of DETA in rats was calculated to be 1.62 mL/kg, which this corresponds to 1553 mg/kg (ECHA). [Kl. Score=2]

Inhalation

The acute inhalation toxicity (OECD 403) was examined where male and female Fischer 344 rats were of exposed nose-only to 0.07 mg/L of aerosolized DETA for 4 hours. All animals survived the four-hour exposure and the two-week observation period. A second exposure was conducted at a chamber concentration of 0.30 mg/L. All animals survived the four-hour exposure. Male rats exposed to 0.30 mg/L DETA were dead by test day 6 and female rats were dead by test day 11. The aerosol particle size distribution mass median aerodynamic diameter (MMAD) averaged 0.44 (estimated) and 2.33 microns for the 0.07 and 0.30 mg/L exposures, respectively. Approximately 67 and 16% of the total mass of particles was less than 1 micron in size and approximately 98 and 94% of the total mass was less than 6 microns in size for the 0.07 and 0.30 mg/L exposures, respectively. All animals underwent a gross pathologic examination. There were no treatment-related observations in animals exposed to 0.07 mg/L DETA. There were several treatment-related observations in 0.30 mg/L group including shallow and/or rapid respiration, decreased activity, perineal soiling, extensive body soiling, thin appearance and decreased urine and feces. Decreased feces and urination were noted post-exposure during cage side examinations for the 0.30 mg/L exposure. The decreased ingesta observed in both male and female animals was consistent with the lower body weights and reduced food intake noted in postexposure cage side and clinical observations. The treatment-related change observed at necropsy in all animals exposed to 0.07 mg/L was atelectasis of the lungs, characterized by a branching pattern of pulmonary collapse involving approximately 25% of the lung parenchyma. Lesions observed in spontaneously dead animals exposed to 0.30 mg/L included pulmonary edema and congestion of the lungs and hydrothorax. These observations were interpreted to be contributing factors to the cause of death. Based on the results of the 0.07 and 0.30 mg/L exposures, the no observed effect level (NOEL) for lethality is 70 mg/m^3 aerosolized DETA (ECHA). [Kl. Score=1]

Dermal

The acute dermal toxicity of diethylenetriamine was examined. A 10% solution of diethylenetriamine was applied to the shaved abdomens of rabbits (6 total) and the animals were observed for 14 days for signs of toxicity. One out of six rabbits died during the study. Clinical signs observed were Immediate erythema, followed by necrosis and finally a leathery scab resulted from the direct action of the material on the skin. The stools of survivors were watery and sometimes blood-tinged. With a 10% aqueous dilution the corrosive action on the skin. Gross pathology examination of the animal that died revealed that the lungs were congested and haemorrhagic; the kidneys showed considerable gross damage including a pitted appearance of the surface and subcapsular

haemorrhage. The LD50 was calculated to be 1045 mg/kg (range 910 mg/kg to 1190 mg/kg). Severe skin damage resulted from the undiluted compound. As a 10% dilution in water the corrosive action is practically eliminated and 2.0 gm/kg (20 ml/kg of the 10% dilution) is not lethal, demonstrating that skin damage abets skin penetration (ECHA). [Kl. Score=2]

D. Irritation

Skin

The skin irritation potential of diethylenetriamine was examined. Concentrations of 40% and 100% diethylenetriamine were applied to the shave skin of rabbits for a duration of 1, 5, or 15 minutes. Post-exposure, the animals were observed for 3 weeks for signs of toxicity. There were no treatment effects at 40%, except for Visible erythema in one animal. A 15-minute exposure to 100% diethylenetriamine resulted in necrosis in two of two rabbits (ECHA). [Kl. Score=2]

Eye

In an eye irritation study, undiluted diethylenetriamine was applied to the eye of a rabbit when an observation period of 8 days. diethylenetriamine produced indications of moderate pain when instilled into the eyes, Initially the conjunctiva of both eyes was severely inflamed and swollen. These membranes were edematous one hour later. These conditions persisted in the unwashed eye for the duration of the test but began to subside in the washed eye after 8 days. The washed cornea was 50% opaque while the unwashed eye was completely opaque one-hour post-instillation; 24 hours later the washed cornea was only cloudy, but the unwashed eye remained opaque for the duration of the test. Examination of the unwashed eye showed the cornea was destroyed. The retina of the unwashed eye was severely damaged. There were no internal effects of the washed eye. This study indicates diethylenetriamine is corrosive to the eye of the rabbit (ECHA). [Kl. Score=2]

E. Sensitisation

Skin

A skin sensitisation study was conducted in accordance with OECD 429 guidelines. Bakb/c mice were administered 2.5, 5, or 10% diethylenetriamine on the dorsum of both ears daily for 3 consecutive days. A further group of control animals was untreated (naïve). Five days after the initiation of exposure, all mice received an intravenous injection of 250ml of phosphate buffered saline containing 20mCi of 3H-methyl thymidine (3H-TdR specific activity 2Ci/mmol; supplied by Amersham International, UK). Five hours later mice were sacrificed and the draining auricular lymph nodes removed and pooled for each experimental group. There was a clear dose response effect was observed. Exposure to diethylenetriamine provoked the lowest increases in radiolabelled thymidine incorporation observed, reaching stimulation indices of 3.3 and 3.5 at 5% and 10%, respectively. Due to local irritation, higher concentrations of this chemical could not be used. It was concluded that diethylenetriamine possessed contact allergic potential (positive in the local lymph node assay) (ECHA). [Kl. Score=1]

Respiratory

Since diethylenetriamine elicited a positive response in the LLNA test, further analyses using cytokine fingerprinting was conducted to determine whether it provoked respiratory sensitization. The mouse IgE test was used for the identification of chemicals that had the potential to cause allergic sensitization of the respiratory tract. The method was based upon the fact that topical

exposure of mice to chemical respiratory allergens elicits a substantial increase in the total serum concentration of IgE; a response not observed with chemical contact allergens believed not to cause respiratory sensitization. diethylenetriamine possesses contact allergic potential (positive in the local lymph node assay but failed to provoke significant cytokine production as judged by cytokine fingerprinting); however, lack of immunogenicity means that it is not possible to confirm a secure negative with respect to respiratory sensitizing potential (ECHA). [Kl. Score=2]

F. Repeated Dose Toxicity

Oral

A Repeated-dose Oral Toxicity study was conducted in accordance with OECD 451 guidelines. Fischer 344 rats (20-30 animals per sex per dose) were exposed to diethylenetriamine in the diet at concentrations of 0, 1000, 7500, or 15000 ppm for 90 days. The doses corresponded to approximate mean intake levels of 70, 530, and 1060 mg/kg/day for the males and 80, 620, and 1210 mg/kg/day for the females of the 1000, 7500, and 15000 ppm groups, respectively. Following the exposure period, ten animals from each of the control and high dose groups were observed for 4 weeks during a recovery phase. No treatment-related clinical signs, gross necropsy findings, or histopathologic findings were observed for either sex at any dose level. No alterations related to treatment in other measurements including food consumption, body weights, ophthalmologic findings, hematology, serum clinical chemistry, urinalysis, or organ weights were observed in the 1000 ppm group for either sex. Several treatment-related effects on in-life, clinical pathology, and organ weight measurements were observed for the 7500 and 15000 ppm groups through the 13-week treatment period. Decreases in food consumption were observed intermittently throughout the dosing period in males and females at the high dose. Dose-related decreases in body weight or weight gain were observed for both sexes in the mid and high dose groups. Minimal changes in clinical pathology measurements that were potentially treatment-related included: for the males, increased MCV and MCH in the high and mid dose groups, and for the females, decreased glucose and albumin, and increased MCV in the high dose group, and similar changes in glucose and MCV in the mid dose group. In addition, increased urine pH in the females from the high and mid dose groups, possibly associated with an increase in kidney weight and/or excretion of the test material, was observed after 13-weeks of exposure. A treatment-related increase in kidney weight was observed in the female rats treated with 7500 or 15000 ppm diethylenetriamine. In addition, liver (mid and high dose groups) and adrenal (high dose group only) weight increases in the females may have been a result of treatment. No other statistically significant changes in any measurements were attributed to direct toxicity of diethylenetriamine at 7500 or 15000 ppm dietary concentrations.

During the recovery period, female rat food consumption was greater than the concurrent control group and body weights returned to control levels. Male body weights remained lower than the controls throughout the recovery period. Most of the other alterations remained affected after the 4-week period. The NOEL for this species and strain over the 90-day test period was 1000 ppm, which corresponds to 70 mg/kg bw/day in males and 80 mg/kg bw/day in females (ECHA). [Kl. Score=1]

Inhalation

The effects of inhaled diethylenetriamine were examined in a subacute inhalation toxicity study. Alderley Park rats were exposed whole body to an essentially saturated vapor of diethylenetriamine for 6 hrs/day for 15 exposures. There were no effects based on urinalysis or haematological parameters and gross or histopathological exam. The no observed effect concentration (NOEC) was 0.55 mg/L or 550 mg/m^3 (ECHA). [Kl. Score=2]

Dermal

The chronic toxicity of diethylenetriamine was studied by subcutaneous injection and by topical application on the skin of male and female Wistar rats. The animals were exposed to 10% of diethylenetriamine daily for six times a week. The animals were kept in pens to observe the toxic effects of diethylenetriamine during their life spans. After the animal's death, the histopathological changes produced thereby in the visceral organs were studied. The average days of survival were 407 days in the treated group, and 581 days for the controls. The maximum survival day of the rats in the control group was 1010 days. There were no notable gross pathologic findings in the rats of each experimental group. The numbers of erythrocytes and leucocytes, the change of body weight and the numbers of litter were not markedly different between the rats given diethylenetriamine and the control. The histopathological changes produced by the administration of diethylenetriamine were observed mainly in kidney and liver. Pneumonia, which seemed to be resulting from the decrease of physical resistance, was also observed in both the treatment and control groups. Some slight histopathological changes were observed in both spleen and adrenal (ECHA). [Kl. Score=2]

G. Genotoxicity

Evidence from *in vitro* and *in vivo* studies indicate that diethylenetriamine in not genotoxic (ECHA).

In Vitro Studies

The *in vitro* genotoxicity studies on diethylenetriamine are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on diethylenetriamine

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial Reverse Mutation Assay (OECD 471) using E.coli WP2 uvrA	+	+	1	ECHA
Mammalian Chromosome Aberration Test (EPA 560/6-82-001)	-	-	1	ECHA
Gene mutation study in mammalian cells: Chinese Hamster Ovary (CHO) Mutation Test Chromatid Exchange (SCE) test Assay for Induction of Unscheduled DNA Synthesis (UDS) in rat liver cells	-	-	2	ECHA

*+, positive; -, negative

In Vivo Studies

An *in vivo* Mammalian Germ Cell Study was conducted in accordance with OECD 488 guidelines with C57BL male mice. Control animals (Group 1) received the vehicle (de-ionized water) and test article-treated animals received diethylenetriamine formulated in the vehicle at doses of 50, 150 and 400 mg/kg/day (Group 2, 3 and 4, respectively). Animals in Groups 1-4 were dosed once daily by oral gavage for 28 consecutive days, at a dose volume of 10 mL/kg. The positive control animals (Group 5) were dosed via oral gavage on Days 1, 2 and 3 with 40 mg/kg/day of N-ethyl-N-nitrosourea (ENU) formulated in phosphate buffer solution, pH 6.00. ENU was also administered at a dose volume of 10 mL/kg. End points evaluated during the study included mortality, clinical signs, body weights (and

body weight changes), organ weights, bioanalytical and mutant frequency data. Treatment with diethylenetriamine did not cause statistically elevated mutant frequency at the cII gene in liver, bone marrow, and stomach (ECHA). [Kl. Score=1]

The mutagenic potential of diethylenetriamine was evaluated in the Drosophila sex-linked recessive lethal (SLRL) assay. The test chemical was administered to Drosophila melanogaster males by adult feeding at an exposure concentration of 60 mM. The concentration of the test chemical for the mutagenicity was based upon toxicity, palatability, and sterility assays. Negative control and positive control males were exposed to 5% aqueous sucrose and 5 mM ethyl methanesulfonate, respectively. The treated post-meiotic germ cell stages were sampled in three broods of 3, 2, and 2 days each. There were no significant differences in the frequencies of SLRL mutation between the negative control and diethylenetriamine-treated groups. Significant increases in SLRL mutations were observed in males treated with the positive control chemical. Hence, under the experimental conditions used, diethylenetriamine was considered as negative in the Drosophila SLRL assay (ECHA). [Kl. Score=2]

Diethylenetriamine was evaluated in the mouse bone marrow micronucleus test. The micronucleus test can detect agents causing chromosomal aberrations and spindle malfunction. The test material was mixed with water and administered to CD-1 (ICR) BR mice by single oral gavage at dose levels of 0 (negative control), 85, 283 and 850 mg/kg body weight (bw). Groups of animals were sacrificed at three intervals, viz., 24, 48, and 72 h after treatment. Mice treated with 120 mg/kg bw cyclophosphamide and sacrificed at 24 h served as positive controls. There were five animals per sex per dose level per sacrifice time. One thousand polychromatic erythrocytes (PCE) were evaluated from each animal and the frequencies of micronucleated polychromatic erythrocytes (MNPCE) were recorded. There were no significant increases in the frequencies of MN-PCE in groups treated with the test chemical compared to negative controls. The positive control mice showed significant increases in MN-PCE. Hence, under the experimental conditions used, the test chemical was considered negative in the mouse bone marrow micronucleus test (ECHA). [Kl. Score=1]

H. Carcinogenicity

Oral

No data available

Inhalation

No data available

Dermal

The dermal carcinogenic potential of diethylenetriamine-high purity (DETA-HP) was assessed by applying 25 µl of a 5% (v/v) solution in deionized water to the backs of 50 male C3H/HeJ mice. A negative control group was dosed with deionized water. Both applications were performed three times a week until the death of the animals. No tumours were observed in the group treated with DETA-HP. A sebaceous adenoma was diagnosed on the skin of the thorax of an animal in the deionized water control group. No significant difference in mortality rates was observed between the treated group and the deionized water control group. DETA-HP was not carcinogenic to the skin of C3H/HeJ mice under the conditions of this study (ECHA). [Kl. Score=2].

I. Reproductive Toxicity

In an OECD 421 Reproduction / Developmental Toxicity study, diethylenetriamine was administered by gavage to male and female Wistar rats at levels of 30, 100 and 300 mg/kg bw exposure was during a 2-week premating period, and during mating and gestation up to day 4 post-partum or at least during a 4-week period, to screen its effect on male and female reproductive performance and on the development of the offspring. During the reproduction study no mortality occurred that could be ascribed to the administration of diethylenetriamine. Data obtained through clinical observations, and macroscopic and microscopic examinations, revealed no effects of the treatment. Mean parental body weights of both males and females in the 300 mg/kg bw diethylenetriamine group were slightly decreased when compared to the control values. Body weight change of the males of the 300 mg diethylenetriamine group was statistically significantly decreased when compared to the males from the control group from days 0-28. For the females of this high dose group body weight change during the premating period (days 0-14) and during gestation (days 0-21) showed a statistically significantly decrease when compared to the control females in both periods.

Food consumption data showed a statistically significant decrease in the females of the 300 mg/kg bw diethylenetriamine group. Maternal performance of the females in the 100 mg and 300 mg/kg bw diethylenetriamine groups were affected: duration of gestation was increased statistically significantly, and post-implantation loss was increased in a dose-related way. No adverse effects were observed concerning the general health and the body weights of the pups. It was concluded that diethylenetriamine, when administered by gavage for 4 weeks, causes a light parental toxicity at levels of 300 mg/kg bw Consequently, the no-adverse effect level for parental toxicity as established in this study is 100 mg/kg bw/day. In view of the reproduction effects, the no-adverse effect level for reproduction and development is 30 mg/kg bw/day (ECHA). [Kl. Score=1]

In an Extended One-Generation Reproductive Toxicity Study (OECD 443), oral administration of diethylenetriamine at dose levels of 25, 100 or 250 mg/kg/day had no adverse systemic effect in F0 or F1 generation animals. Treatment of F0 generation and selected F1 generation animals was generally well tolerated at 25 or 100 mg/kg/day but there were three F0 mortalities and one F1 mortality attributed to respiratory disturbances at 250 mg/kg/day. The deaths were considered due to treatment, as all had test item related microscopic changes in the respiratory system consistent with inhalation of residual test item following dosing. This was considered to reflect a local irritant effect. Based on the results of this study it is concluded that the No Observed Adverse Effect Level (NOAEL) for systemic toxicity which has the potential to be harmful to human health in the F0 parent animals was 250 mg/kg/day. The NOAEL for reproductive performance of the F0 parent animals and survival and growth of the F1 offspring to PND 21 was 250 mg/kg/day. The NOAEL for development of F1 generation offspring following weaning was 250 mg/kg/day. The NOAEL for systemic toxicity in the F1 generation was 250 mg/kg/day [Kl. Score=1](ECHA).

J. Developmental Toxicity

Oral

In the previously discussed OECD 421 Reproduction / Developmental Toxicity study, no adverse effects were observed concerning the general health and the body weights of the pups. A NOAEL for development is 30 mg/kg bw/day [Kl. Score=1](ECHA).

In an OECD 414 Prenatal Developmental Toxicity Study, the potential developmental toxicity of Diethylenetriamine (DETA) (at 0, 100, 300 and 1000 mg/kg/day) when given orally during the period of organogenesis and foetal period to pregnant rats was analysed. The following parameters and end

points were evaluated in this study: clinical observations, body weights and body weight changes, food consumption, gross necropsy findings, gravid uterine weight, examination of pregnancies and fetal evaluations (external abnormalities, fetal weights, visceral and skeletal evaluations). Animals were killed on Day 20 of gestation. Administration of diethylenetriamine at 250 mg/kg/day was associated with a reduction in maternal body weight gain over Days 6-20 of gestation; however, when administered along with a copper supplemented diet there was an initial slight reduction in maternal body weight gain but this found to be similar to controls by the end of the dosing period. Also, at 250 mg/kg/day, with or without copper supplemented diet, there was a reduction in fetal and uterine weights along with a slightly reduced state of fetal ossification (including reduced ossification of sternabrae, metacarpals and phalangeal elements). There were no fetal malformations or abnormalities that were test item-related at any dose level and there were no effects of treatment noted in any of the maternal or fetal parameters examined at dose levels up to and including 100 mg/kg/day. In conclusion, the fetal NOEL was 100 mg/kg/day based on the reduced fetal weights and slight decrease in fetal ossification observed at the higher dose level of 250 mg/kg/day. These effects were considered not to be adverse and in the absence of any test item related fetal malformations and abnormalities at all dose levels the fetal NOAEL was the highest dose level of 250 mg/kg/day. The maternal NOEL and NOAEL were 100 mg/kg/day based on the reduced maternal body weight gain observed at the higher dose level of 250 mg/kg/day (ECHA). [Kl. Score=1]

Inhalation

No data available

Dermal

No data available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for diethylenetriamine follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

In a one-generation reproduction/developmental toxicity screening test conducted on male and female Wistar rats, a NOAEL of 30 mg/kg bw/day was determined. This NOAEL was similar to the NOAEL of 70 mg/kg bw/day determined for male Fischer rats in a 90-day oral repeat dose toxicity study. The NOAEL of 30 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1

UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 30/(10 x 10 x 1 x 10 x 1) = 30/1000 = 0.03 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:
Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.03 x 70 x 0.1)/2 = 0.10 mg/L

B. Cancer

Diethylenetriamine is not genotoxic. DETA-HP was not carcinogenic to the skin in a dermal carcinogenicity study conducted on mice. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Diethylenetriamine does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Diethylenetriamone is expected to have low acute and chronic toxicity to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on diethylenetriamine.

Table 3: Acute Aquatic Toxicity Studies on diethylenetriamine

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Poecilia reticulata (Guppy fish)	96-hr LC_{50}	430	2	ECHA

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Daphnia magna (Water flea)	48-hr EC_{50}	32 (geometric mean)	2	ECHA
Pseudokirchnerella subcapitata (Green alga)	72-hr EC_{50}	1,164 (growth)	2	ECHA

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on diethylenetriamine.

Table 4: Chronic Aquatic Toxicity Studies on diethylenetriamine

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Gasterosteus aculeatus (Three-spined stickleback fish)	28-day NOEC	>10	2	ECHA
Daphnia magna (Water flea)	21-day NOEC	5.6	2	ECHA
Pseudokirchnerella subcapitata (Green alga)	72-hr NOEC	10 (growth)	2	ECHA

C. Terrestrial Toxicity

An eight-week study with earthworms (*Eisenia fetida*) applied concentrations of 62.5, 125, 250, 500, and 1,000 mg/kg dw in artificial soil containing 10 percent peat. The study identified a chronic NOEC of 500 mg/kg dw based on reproduction and an acute EC_{50} of 797 mg/kg dw based on reproduction (ECHA) [KI. Score = 1].

D. Calculation of PNEC

The PNEC calculations for diethylenetriamine follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (430 mg/L), invertebrates (32 mg/L), and algae (1,164 mg/L). NOEC values from long-term studies are available for fish (>10 mg/L), invertebrates (5.6 mg/L) and algae (10 mg/L). On the basis that the data consists of short-term and long-term results from three trophic levels, an assessment factor of 10 has been applied to the lowest reported NOEC of 5.6 mg/L for invertebrates. The $PNEC_{water}$ is 0.56 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 161 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
= (367.73/1280) x 1000 x 0.56
= 160.88 mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
= 0.8 + [(0.2 x 764.44/1000 x 2400]
= 367.73 m^3/m^3

Where:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
= 19,111 x 0.04
= 764.44 L/kg

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for diethylenetriamine is 19,111 L/kg.
F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There is limited data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 143 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
= (382.22/1500) x 1000 x 0.56
= 142.7 mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
$Kp_{soil} = K_{oc} \times f_{oc}$
= 19,111 x 0.02
= 382.22 m^3/m^3

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for diethylenetriamine is 19,111 L/kg.
F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Diethylenetriamine is readily biodegradable and thus does not meet the screening criteria for persistence.

The range of measured BCF in fish is <0.3 to 6.3. Thus, diethylenetriamine does not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on diethylenetriamine are > 0.1 mg/L. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies are > 1 mg/L. Thus, diethylenetriamine does not meet the criteria for toxicity.

The overall conclusion is that diethylenetriamine is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Acute Toxicity Category 4 (Dermal)

Acute Toxicity Category 4 (Oral)

Skin Corrosion Category 1B

Skin Sensitiser Category

B. Labelling

Danger

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

Wash immediately and continuously with flowing water for at least 30 minutes. Remove contact lenses after the first 5 minutes and continue washing. Obtain prompt medical consultation, preferably from an ophthalmologist.

Skin Contact

In case of contact, immediately wash skin with a mild non-abrasive soap and plenty of warm water for 30 minutes. Remove contaminated clothing. Wash clothing before reuse. Shoes and other leather items which cannot be decontaminated should be disposed of properly.

Inhalation

Move person to fresh air. If not breathing, give artificial respiration; if by mouth-to-mouth use rescuer protection (pocket mask, etc). If breathing is difficult, oxygen should be administered by qualified personnel. Call a physician or transport to a medical facility.

Ingestion

Do not induce vomiting. Call a physician and/or transport to emergency facility immediately.

B. Fire Fighting Information

Extinguishing Media

Water fog or fine spray. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam. Do not use direct water stream. May spread fire. Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective.

Specific Exposure Hazards

Violent steam generation or eruption may occur upon application of direct water stream to hot liquids. Hazardous Combustion Products: During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. Combustion products may include and are not limited to: Carbon dioxide, carbon monoxide, nitrogen oxides.

Special Protective Equipment for Firefighters

Wear positive-pressure self-contained breathing apparatus (SCBA) and protective firefighting clothing (includes firefighting helmet, coat, trousers, boots, and gloves). Avoid contact with this material during firefighting operations. If contact is likely, change to full chemical resistant firefighting clothing with self-contained breathing apparatus. If this is not available, wear full chemical resistant clothing with self-contained breathing apparatus and fight fire from a remote location. For protective equipment in post-fire or non-fire clean-up situations, refer to the relevant sections. .

C. Accidental Release Measures

Personal Precautions

Use appropriate safety equipment. Evacuate area. Keep upwind of spill. Ventilate area of leak or spill. Only trained and properly protected personnel must be involved in clean-up operations.

Environmental Precautions

Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. Material will float on water.

Steps to be Taken if Material is Released or Spilled

Contain spilled material if possible. Small spills: Absorb with materials such as: Clay. Dirt. Milsorb®. Sand. Do NOT use absorbent materials such as: Cellulose. Sawdust. Ground corn cobs. Remove with shovel. Collect in suitable and properly labelled containers. Large spills: Dike area to contain spill. Knock down and dilute vapours with water fog or spray. Collect with vacuum equipment. Ground and bond all containers and handling equipment. Wash the spill site with large quantities of water..

D. Storage And Handling

General Handling

Keep container closed. Use with adequate ventilation. Wash thoroughly after handling. Do not get in eyes, on skin, on clothing. Do not swallow. Avoid breathing vapor or mist. Do not use sodium nitrite or other nitrosating agents in formulations containing this product. Suspected cancer-causing nitrosamines could be formed.

Storage

Stainless steel. Aluminum. Maintain a nitrogen atmosphere. Protect from atmospheric moisture. Minimize sources of ignition, such as static build-up, heat, spark or flame. Do not store in: copper, copper alloys, brass, or bronze.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

The workplace exposure standards for diethylenetriamine in Australia is as follows: 4.2 mg/m^3.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Atmospheric levels should be maintained below the exposure guideline. When respiratory protection is required, use an approved air-purifying or positive-pressure supplied-air respirator depending on the potential airborne concentration. Use the following CE approved air-purifying respirator: Organic vapor cartridge with a particulate pre-filter, type AP2.

Hand Protection: Use chemical resistant gloves classified under Standard EN374: Protective gloves against chemicals and micro-organisms. Examples of preferred glove barrier materials include: chlorinated polyethylene, polyethylene. Ethyl vinyl alcohol laminate ("EVAL"). Examples of acceptable glove barrier materials include: butyl rubber, natural rubber ("latex"), neoprene. polyvinyl chloride ("PVC" or "vinyl"), nitrile/butadiene rubber ("nitrile" or "NBR"), polyvinyl alcohol ("PVA"), viton. When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended. When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended. NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier..

Skin Protection: Use protective clothing chemically resistant to this material. Selection of specific items such as face shield, boots, apron, or full body suit will depend on the task. Safety shower should be located in immediate work area. Remove contaminated clothing immediately, wash skin area with soap and water, and launder clothing before reuse or dispose of properly. Items which cannot be decontaminated, such as shoes, belts and watchbands, should be removed and disposed of properly.

Eye protection: Use chemical goggles. Chemical goggles should be consistent with EN 166 or equivalent. If exposure causes eye discomfort, use a full-face respirator. Eye wash fountain should be located in immediate work area.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

UN 2079, DIETHYLENETRIAMINE (DIETHYLENETRIAMINE)

XI. DISPOSAL MANAGMENT

This product, when being disposed of in its unused and uncontaminated state should be treated as a hazardous waste according to EC Directive 91/689/EEC. Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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1-METHOXY-2-PROPANOL

This dossier on 1-methoxy-2-propanol presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): 1-Methoxypropan-2-ol

CAS RN: 107-98-2

Molecular formula: $C_4H_{10}O_2$

Molecular weight: 90.122 g/mol

Synonyms: 1-Methoxy-2-propanol, 2-Propanol, 1-methoxy-, Methyl proxitol, 1-Methoxy-2-hydroxypropane

SMILES: COCC(C)O

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of 1-methoxy-2-propanol

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Colourless organic liquid with an ether-like odour	2	ECHA
Melting Point	-96.15°C @ 101.3 kPa	2	ECHA
Boiling Point	120.17°C @ 101.3 kPa	2	ECHA
Density	916 kg/m^3@ 25°C	2	ECHA
Vapour Pressure	1133.24 Pa @ 20°C 1559.87 Pa @ 25°C	2	ECHA
Partition Coefficient (log K_{ow})	0.37 @ 20°C	2	ECHA
Water Solubility	>1000 g/L @ 20°C Completely miscible with water	2	ECHA
Flash Point	31°C (Setaflash open cup method)	2	ECHA
Auto flammability	287°C	2	ECHA
Viscosity	1.70 mPa s @ 25°C	2	ECHA

Property	Value	Klimisch Score	Reference
Henry's Law Constant	0.0932 Pa m^3/mol@ no temperature specified	2	NCBI, 2026

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

1-Methoxy-2-propanol is readily biodegradable. It has a low potential for bioaccumulation. It is not expected to strongly adsorb to soil or sediment.

B. Biodegradation

1-Methoxy-2-propanol is readily biodegradable. In an aerobic study using microorganisms from the secondary effluent stage of a sewage treatment works, there was 96% degradation after 28 days, as determined by loss of dissolved organic carbon (ECHA) [KI. Score = 1].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

Based on a soil organic carbon coefficient (K_{oc}) of 1 L/kg, 1-methoxy-2-propanol is expected to have high mobility in soil and it is not expected to strongly adsorb to soil or sediment (ECHA). Based on its vapour pressure, 1-methoxy-2-propanol is expected to volatilise from dry soil surfaces, but not volatilize from moist soil surfaces or water (NCBI, 2026).

If released to water, based on its high water solubility, the substance is expected to preferentially partition to the water column. It is not expected to undergo hydrolysis in the environment because of the lack of functional groups that hydrolyse under environmental conditions (NCBI, 2026).

D. Bioaccumulation

Based on a log K_{ow} of 0.37, 1-methoxy-2-propanol has a low potential for bioaccumulation (ECHA).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

1-Methoxy-2-propanol exhibits low acute toxicity by the oral route and very low toxicity via inhalation and dermal exposures. It is not a sensitiser to the skin or respiratory system. The substance is not genotoxic when tested in both *in vitro* and *in vivo* assays. There is some evidence in animal studies that this substance may have an adverse effect on reproductive or developmental endpoints at high exposures. It is not carcinogenic by the inhalation route.

B. Metabolism

After oral exposure in rats, the main target organs for distribution were the liver, thymus and spleen with little concentrations in fat and testes (Miller et al., 1983 as cited by ECHA). Absorption of 1-

methoxy-2-propanol readily occurs via oral and inhalation routes (100%) but is more limited through dermal contact (30%). The data available do not indicate that 1-methoxy-2-propanol accumulates in the body (ECHA). [Kl. Score = 1]

Available physiologically based pharmacokinetic (PBPK) models for 1-methoxy-2-propanol toxicokinetic are limited to absorption of vapour through the skin. This exposure pathway is estimated to contribute only 5-10% of the total body burden. Once absorbed, metabolism of 1-methoxy-2-propanol occurs primarily through oxygen demethylation leading to the formation of propylene glycol. Other pathways of metabolism include glucurono- and sulfo-conjugation also resulting in the formation of propylene glycol. Propylene glycol is excreted by the body in the urine or enters additional metabolic pathways ultimately resulting in the formation of carbon dioxide (CO_2). These pathways are rapidly saturable which, under experimental conditions, results in the urinary excretion of 1-methoxy-2-propanol unchanged (ECHA). [Kl. Score = 2]

C. Acute Toxicity

Oral

In an acute toxicity study following EU Method B.1, male and female Fischer 344 rats were orally gavaged with a single dose a of 1-methoxy-2-propanol at 2500, 3150, 3970 and 5000 milligrams per kilograms body weight (mg/kg-bw). 50% mortality was observed in the group treated at 3970 mg/kg-bw. The combined LD50 for females (4277 mg/kg-bw) and males (3739 mg/kg-bw) was 4016 mg/kg-bw, which is identified as the LD50 for 1-methoxy-2-propanol (ECHA). [Kl. Score = 1].

Inhalation

The acute inhalation of 1-methoxy-2-propanol was evaluated following OECD Guideline 403 in male and female Fischer 344 rats exposed for 6 hours to measured concentrations of 6038 and 7559 parts per million in air (ppm). No mortality was observed with temporary clinical observations (unresponsive to noise, staggered movement) which resolved by the two-week gross examination. Therefore, the LD50 for 1-methoxy-2-propanol was determined to be >7000 ppm (nominal concentration) (ECHA). [Kl. Score = 1]

In a similar OECD Guideline 403 study, the acute inhalation of 1-methoxy-2-propanol was evaluated in male and female B6C3F1 mice exposed for 6 hours to measured concentrations of 6038 and 7559 ppm. In female mice, over 50% (four of five mice) mortality was observed at 6038 ppm while only one male mouse died at the 7559 ppm exposure. Therefore, the LD50 for 1-methoxy-2-propanol was determined to be <6000 ppm for female mice (nominal concentration) and >6000 and <7000 ppm (ECHA). [KI. Score = 1]

Dermal

In an acute dermal toxicity study following EU Method B.3, male and female Fischer 344 rats were exposed to a concentration of 2000 mg/kg-bw 1-methoxy-2-propanol. No mortality or other overt signs of clinical toxicity were observed. Therefore, the LD50 for dermal exposure to 1-methoxy-2-propanol is >2000 mg/kg-bw (ECHA). [Kl. Score = 1].

D. Irritation

Skin

A skin irritation test following EU Method B.4 was conducted on male and female New Zealand White rabbits at a concentration of 0.5 mL undiluted 1-methoxy-2-propanol for 4 hours of exposure. Scores of zero, indicating little to no clinical toxicity, were recorded for erythema, oedema and overall irritation at observation periods of 0.5, 24, 48 and 72 hrs post exposure. Based this study, 1-methoxy-2-propanol was not classified as a skin irritant (ECHA) [Kl. Score=1].

Eye

An eye irritation test following EU Method B.5 was conducted on male and female New Zealand White rabbits with single ocular exposure to 0.1 mL of undiluted 1-methoxy-2-propanol. Clinical observations of irritation including conjunctival redness, chemosis, corneal opacity and damage to the iris were recorded at 1 hour and 1, 2, 3 and 7 days post exposure. Within the 7-day post-exposure observation period, these signs were noted to be fully reversible. Based this study, a classification of eye irritancy was not required for 1-methoxy-2-propanol (ECHA) [Kl. Score=1].

E. Sensitisation

Overall, no dermal sensitisation was observed in two studies in guinea pigs. A skin sensitisation test following EU Method B.6 was conducted on an unspecified strain of male and female guinea pigs. In this Maximization test, 0.1 millilitre (mL) of undiluted 1-methoxy-2-propanol was injected intradermally and topically applied for 48 hrs. No clinical observations of skin sensitisation were observed immediately following patch removal or after an additional 24 and 48 hrs (ECHA). [Kl. Score=1]

In a second skin sensitisation study, a modified method of MacGuire et al. (1973) (as cited by ECHA), male Hartley guinea pigs were exposed four times over an exposure period of seven days (at a frequency of every 48 hours) to 0.1 mL of undiluted 1-methoxy-2-propanol; three dermal applications and one intradermal injection adjacent to the insult site between the second and third dermal applications. No clinical signs of skin sensitisation compared to positive controls were recorded for the test subjects after 48 hours (ECHA). [KI. Score = 2]

Based on the absence of skin sensitisation potential, genotoxicity and irritancy, 1-methoxy-2-propanol is not expected to be a respiratory tract sensitiser (ECHA).

F. Repeated Dose Toxicity

Oral

Few studies of oral toxicity are available for 1-methoxy-2-propanol. An OECD guideline 407 study (Repeated Dose 28-Day Oral Toxicity Study in Rodents) was conducted for an unspecified strain of male rats at 91.9, 275.7, 919, and 2757 milligrams per kilogram body weight per day mg/kg/day 1-methoxy-2-propanol in olive oil. No mortality, clinical signs of toxicity or differences in gross and histopathological findings were observed after exposure at any dosing regimen. For the 2757 mg/kg/day group, a reversible reduction in body weight was observed. Based on this study, a NOAEL of 919 mg/kg/day was identified for 1-methoxy-2-propanol (ECHA). [KI. Score = 2].

Inhalation

A chronic OECD 453 study was conducted using male and female Fischer 344 rats exposed for 6 hours per day (hr/day), 5 days/week for two years to 1-methoxy-2-propanol vapour at concentrations of 300, 1000 and 3000 ppm. In males, a treatment related increase in mortality was observed at the highest dose, 3000 ppm, although no effect on mortality was observed for female rats. At doses of 1000 ppm and 3000 ppm, male rats were observed to have elevated serum alkaline phosphatase activity. Based on this study, a NOAEL of 300 ppm was identified for to 1-methoxy-2-propanol in air (ECHA). [KI. Score = 1]

A chronic OECD 453 study was conducted using male and female B6C3F1 mice exposed for 6 hr/day, 5 days/week for two years to 1-methoxy-2-propanol vapour at concentrations of 300, 1000 and 3000 ppm. In males, a slight treatment related increase in mortality was observed at the highest dose, 3000 ppm, although no effect on mortality was observed for female rats. No significant differences were observed for exposed mice for other endpoints including body/organ weight, ophthalmological and haematological effects as well as gross and histopathological findings. Based on this study, a NOAEL of 1000 ppm was identified for to 1-methoxy-2-propanol in air (ECHA). [KI. Score = 1]

An OECD Guideline 413 (Subchronic Inhalation Toxicity: 90-Day Study) test was conducted using Fischer 344 male and female rats exposed for 6 hr/day, 5 days/week for 13 weeks to 1-methoxy-2-propanol vapour at concentrations of 300, 1000 and 3000 ppm. In the highest dose group, 3000 ppm, mean relative liver weight (both sexes) and mean absolute liver weight (females only) were statistically greater relative to the control group. Aside from a slight transient change in body weight in females, no significant differences were observed in rats for other endpoints including mortality, clinical observations, body/organ weight, biochemical, urinalysis, haematological effects as well as gross and histopathological findings. Based on this study, a NOAEL of 1000 ppm was identified for to 1-methoxy-2-propanol in air (ECHA). [KI. Score = 1]

Another OECD Guideline 413 test was conducted using New Zealand White male and female rabbits exposed for 6 hr/day, 5 days/week for 13 weeks to 1-methoxy-2-propanol vapour at concentrations of 300, 1000 and 3000 ppm. Mild clinical effects, such as appearing sedated during the initial exposures, were observed in the highest dose group, 3000 ppm, although these effects were not observed after the first week. No other significant effects were observed in rabbits for other endpoints including mortality, body/organ weight, biochemical, haematological effects as well as gross and histopathological findings. Based on this study, a NOAEL of 1000 ppm was identified for to 1-methoxy-2-propanol in air (ECHA). [KI. Score = 1]

Dermal

A dermal OECD 410 study was conducted on New Zealand White male and female rabbits. Dermal exposure consisted of a 1000 mg/kg-bw amount of undiluted 1-methoxy-2-propanol applied to the back of each rabbit and bandaged to maximize exposure/absorption. Once per day applications occurred 15 times over an exposure period of 21 days. No clinical or systemic effects, including mortality, body weight, haematologic, biochemical, and gross and histopathological findings were observed. In the treated group (1000 mg/kg-bw), slight exfoliation and other signs (focal skin lesions, hyperkeratosis, slight thickening of the epidermis) were attributed to inflammation, degeneration and other protective of effects of the dermis at the application site only. Based on this study, a NOAEL of 1000 mg/kg/day was identified for systemic effects of dermal exposure to 1-methoxy-2-propanol (ECHA). [KI. Score = 1]

A 90-day subchronic dermal toxicity study, equivalent to OECD 411, was conducted on an unspecified strain of male rabbits. Dermal exposures of 1838, 3676, 6433 and 9190 mg/kg-bw 1-methoxy-2-propanol in water were applied five days a week to the shaved abdomens of test subjects and bandaged. Mortality, due to narcosis, and statistically significant decreases in body weight and food consumption were observed in rabbits exposed to 6433 and 9190 mg/kg-bw. No other effects, including haematological findings, organ weights and gross and histopathological findings were observed within any test group. Based on this study, a NOAEL of 1838 mg/kg/day was identified for dermal exposures to 1-methoxy-2-propanol (ECHA). [KI .Score = 2]

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on 1-methoxy-2-propanol are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on 1-Methoxy-2-Propanol

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay) (*Salmonella typhimurium TA1538, TA1537, TA1535, TA98, TA100*)	-	-	1	ECHA
OECD Guideline 473 equivalent (*In vitro* Mammalian Chromosome Aberration Test) (Chinese hamster ovary (CHO))	-	-	1	ECHA
OECD Guideline 476 equivalent (*In vitro* Mammalian Cell Gene Mutation Test) (Chinese hamster lung fibroblasts (V79))	-	N/A	2	Elias et al. (1996)

*+, positive; -, negative, N/A – not applicable

In Vivo Studies

In a study of male and female CD-1 mice, test subjects were intraperitoneally injected with 0.2 millilitres (mL) of 1-methoxy-2-propanol and Hank's balanced salt solution (HBSS) at corresponding doses of 2500, 4000, 5000, and 6000 mg/kg-bw. At 24, 48 and 72 hours, bone marrow cells were collected and evaluated for frequency of micronuclei in polychromatic erythrocytes. Although mortality of test subjects was observed at the highest test dose (6000 mg/kg), no increases in genotoxicity were observed and 1-methoxy-2-propanol was classified as negative (Elias et al. 1996 as cited by ECHA). [KI. Score = 2]

H. Carcinogenicity

Oral

No oral studies for carcinogenicity are available for 1-methoxy-2-propanol.

Inhalation

A chronic OECD 453 study was conducted using male and female Fischer 344 rats exposed for 6 hr/day, 5 days/week for two years to 1-methoxy-2-propanol vapour at concentrations of 300, 1000 and 3000 ppm. At the end of the treatment period, no carcinogenic evidence (as increases in tumour

incidence) was observed within any treatment group. Based on this study, a NOAEL of 3000 ppm for carcinogenicity was identified for to 1-methoxy-2-propanol in air (ECHA). [KI Score = 1]

A chronic OECD 453 study was conducted using male and female B6C3F1 mice exposed for 6 (hr/day), 5 days/week for two years to 1-methoxy-2-propanol vapour at concentrations of 300, 1000 and 3000 ppm. At the end of the treatment period, no carcinogenic evidence (as increases in tumour incidence) was observed within any treatment group. Based on this study, a NOAEL of 3000 ppm for carcinogenicity was identified for to 1-methoxy-2-propanol in air (ECHA). [KI. Score = 1]

Dermal

No dermal studies for carcinogenicity are available for 1-methoxy-2-propanol.

I. Reproductive Toxicity

An OECD guideline 416 study (two-generation reproductive toxicity) was conducted for exposures to 1-methoxy-2-propanol in vapour. Male and female Sprague-Dawley rats were exposed to 1-methoxy-2-propanol vapour at concentrations of 300, 1000 and 3000 ppm for 6 hr/day, 5 days/week for ten weeks prior to mating. During mating, gestation and lactation, exposures were increased to 6 hr/day for 7 days/week. The second generation were exposed after six weeks for 10 weeks under the same 6 hr/day, 5 days/week regimen prior to mating and producing F1a and F1b litters. as the first generation before mating. At 3000 ppm, some clinical effects (sedation) and effects on organ weights were observed, but no reproductive endpoints (oestrus cycle, sperm measure, reproductive performance, offspring survivability) were observed at any concentration within any generation. In both the F1 and F2 offspring, a transient decrease in body weight gain was observed in female rats exposed at 1000 ppm. Based on this study, a NOAEL of 1000 ppm was identified for reproductive effects (F1/F2 generations) (ECHA). [KI. Score = 1]

J. Developmental Toxicity

Oral

No oral development studies are available.

Inhalation

An OECD Guideline 414 test (Prenatal Developmental Toxicity Study) was conducted on male and female Sprague-Dawley rats exposed to 1-methoxy-2-propanol vapour at concentrations of 500, 1500 and 3000 ppm for 6 hr/day during days 6-15 of the gestation period. In addition to slight material toxicity (weight decrease), rats in the 3000 ppm exposure group had a slightly statistically significant increase in delayed sternebral ossification in pups. Based on this study, a NOAEL of 1500 ppm was identified for teratogenic effects of 1-methoxy-2-propanol in vapour (Hanley et al. 1984 as cited by ECHA). [KI. Score = 1]

An OECD Guideline 414 test (Prenatal Developmental Toxicity Study) was conducted on male and female New Zealand White rabbits exposed to 1-methoxy-2-propanol vapour at concentrations of 500, 1500 and 3000 ppm for 6 hr/day during days 6-18 of the gestation period. Although CNS effects (as mild lethargy) were observed for maternal toxicity, no embryonic or teratogenic effects were observed within any exposure group. Based on this study, a NOAEL of 3000 ppm was identified for teratogenic effects of 1-methoxy-2-propanol in vapour (Hanley et al. 1984 as cited by ECHA). [KI. Score = 1]

Dermal

No dermal development studies are available.

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for 1-methoxy-2-propanol follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

An OECD Guideline 407 oral subchronic study was conducted on male rats. The NOAEL from this study is 919 mg/kg-day based on no effect for survival, clinical signs of toxicity, and gross and histopathological findings. This NOAEL will be used to derive an oral reference dose and drinking water guideline value for 1-methoxy-2-propanol.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 3
Oral RfD = 919/(10 x 10 x 1 x 10 x 1) = 919/3000 = 0.31 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.31 x 70 x 0.1)/2 = 1.1 mg/L

B. Cancer

No oral studies were available for the carcinogenicity of 1-methoxy-2-propanol. Thus, a cancer reference value for the substance was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

1-Methoxy-2-propanol is flammable. It does not exhibit the following physico-chemical properties:

- Explosivity
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

1-Methoxy-2-propanol is expected to have low acute and chronic toxicity to aquatic organisms. No studies are available for terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on 1-methoxy-2-propanol.

Table 3: Acute Aquatic Toxicity Studies on 1-Methoxy-2-Propanol

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Leuciscus idus (Golden orfe fish)	96-hr LC_{50}	4,600 – 10,000	2	ECHA
Oncorhynchus mykiss (Rainbow trout fish)	96-hr LC_{50}	≥1,000	2	ECHA
Pimephales promelas (Fathead minnow fish)	96-hr LC_{50}	20,800	2	ECHA
Daphnia magna (Water flea)	48-hr LC_{50}	23,300 (mobility, mean)	2	ECHA

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on 1-methoxy-2-propanol.

Table 4: Chronic Aquatic Toxicity Studies on 1-Methoxy-2-Propanol

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Raphidocelis subcapitata (Green alga)	7-day EC_{50}	1,000 (growth)	1	ECHA

C. Terrestrial Toxicity

No studies available.

D. Calculation of PNEC

The PNEC calculations for 1-methoxy-2-propanol follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (≥1,000 mg/L) and invertebrates (23,300 mg/L). NOEC values from long-term studies are available for algae (1,000 mg/L). On the basis that the data consists of short-term results from two trophic levels and long-term results from one trophic level, an assessment factor of 1000 has been applied to the reported EC_{50} of 1,000 mg/L for algae. The $PNEC_{water}$ is 1.0 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 0.64 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (0.82/1280) \times 1000 \times 1$
$= 0.64$ mg/kg

Where:

$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 0.04/1000 \times 2400]$
$= 0.82\ m^3/m^3$

Where:

Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
$= 1 \times 0.04$
$= 0.04$ L/kg

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for 1-methoxy-2-propanol follow calculated from EPISUITE™ using the MCI is 1 L/kg (NCBI, 2026).
F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are no toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 0.013 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
= (0.02/1500) x 1000 x 1
= 0.013 mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
$Kp_{soil} = K_{oc} \times f_{oc}$
= 1 x 0.02
= 0.02 m^3/m^3

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for 1-methoxy-2-propanol follow calculated from EPISUITE™ using the MCI is 1 L/kg (NCBI, 2026).
F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

1-Methoxy-2-propanol is readily biodegradable and thus does not meet the screening criteria for persistence.

Based on a log K_{ow} of 0.37, 1-methoxy-2-propanol does not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on 1-methoxy-2-propanol are > 0.1 mg/L. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies on 1-methoxy-2-propanol are > 1 mg/L. Thus, 1-methoxy-2-propanol does not meet the criteria for toxicity.

The overall conclusion is that 1-methoxy-2-propanol is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Flammable liquid Category 3

Specific target organ toxicity (single exposure) – (target organ: numerous with highest percentage to the central nervous system -23.19%)

B. Labelling

Warning

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact

Remove contaminated clothes. Wash thoroughly with soap and plenty of water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water. Do not induce vomiting. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Avoid breathing vapours, mist or gas. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. Do not let product enter drains. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

The workplace exposure standards for 1-methoxy-2-propanol in Australia is as follows: 369 mg/m^3 (time weighted average) and 553 mg/m^3 (short term exposure limit).

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

1-Methoxy-2-propanol is considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code Class 3 UN No 3092 is required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

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2-METHOXY-1-PROPANOL

This dossier on 2-methoxy-1-propanol presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed 2-methoxy-1-propanol in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to the environment[1].

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): 2-methoxypropan-1-ol

CAS RN: 1589-47-5

Molecular formula: $C_4H_{10}O_2$

Molecular weight: 90.122 g/mol

Synonyms: 2-methoxy-1-propanol; 1-Propanol, 2-methoxy-; 2-methoxypropanol

SMILES: COC(C)CO

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of 2-methoxy-1-propanol

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Clear Liquid with a mild ether odour	-	NCBI, 2026
Melting Point	-55.74@ 101.3 kPa (modelled)	-	Health Canada, 2009
Boiling Point	130°C @ pressure not indicated	-	NCBI, 2026
Density	938 kg/m^3@ 20 °C	-	NCBI, 2026
Vapour Pressure	547 Pa @ 25 °C	-	NCBI, 2026
Partition Coefficient (log K_{ow})	-0.49 @ 25 °C	-	NCBI, 2026
Water Solubility	1,000 g/L @ 25 °C	-	Health Canada, 2009

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=a660433e-f36b-1410-8924-008e64e216c7

Property	Value	Klimisch Score	Reference
Flash Point	Not Available	-	-
Auto flammability	Not Available	-	-
Viscosity	Not Available	-	-
Henry's Law Constant	0.0018 Pa m^3/mol@ temperature not provided	-	NCBI, 2026

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

2-Methoxy-1-propanol is expected to be readily biodegradable based on read-across. It is not expected to bioaccumulate. It is expected to not strongly adsorb to soil or sediment.

B. Biodegradation

No biodegradation studies in water or solids are available for 2-methoxy-1-propanol. Read-across substance 1-methoxy-2-propanol is readily biodegradable.

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

Based on a soil organic carbon partition coefficient (K_{oc}) of 1 L/kg, 2-methoxy-1-propanol is expected to not strongly adsorb to soil. Based on its Henry's Law Constant, volatilisation from moist soil surfaces is not expected to be an important fate process. However, volatilisation from dry soil surfaces is likely to occur (NCBI, 2026).

If released to water, based on its low K_{oc} value and high water solubility, 2-methoxy-1-propanol is expected to preferentially partition to the water column. Similar to soil, volatilisation from water surfaces is not expected (NCBI, 2026).

D. Bioaccumulation

No experimental data is available. Based on log K_{ow} value of -0.49 (NCBI, 2026), 2-methoxy-1-propanol has a low potential for bioaccumulation.

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Follow oral administration, 2-methoxy-1-propanol is metabolized to 2-methoxypropionic acid and is primarily excreted in the urine. This material has a low potential for acute oral and inhalation toxicity. 2-Methoxy-1-propanol is slightly irritating to the skin and eyes. Repeat dose exposure via the oral and inhalation routes resulted in moderate health effects. 2-Methoxy-1-propanol was non-genotoxic in *in vitro* models. This material has effects on the reproductive systems of male and female animals; the metabolite also has developmental effects.

B. Metabolism

Male rats were administered a single oral dose of 14C-labelled 2-methoxy-1-propanol, the main metabolite in the high and low dose groups was 2-methoxypropionic acid This metabolite accounted for 93% and 79% of the radioactivity recovered in the urine, respectively. In addition, a glucuronide metabolite was found at both dose levels, which accounted for 3% to 4% of the radioactivity recovered in the urine (MAK, 2025).

C. Acute Toxicity

Oral

In an acute oral toxicity study, groups of 5 male and 5 female Sprague Dawley rats were administered single oral doses of 2-methoxy-1-propanol of 2150 or 5000 mg/kg body weight. Dyspnoea, apathy, unsteady and spastic gait, unkempt fur and poor general condition were observed in the high dose group. Two females in the high dose group died during the first day; they were found to have slightly distended lungs and acute dilation on the right side of the heart with congestive hyperaemia. Gross-pathological examination did not reveal any abnormal findings in the animals killed after 14 days. The oral LD50 was therefore > 5000 mg/kg body weight (MAK, 2025).

Inhalation

In an acute inhalation toxicity study, 10 male and 10 female Sprague Dawley rats were exposed to 2-methoxy propanol-1 vapour at concentrations of 0 or 6000 mg/m3 for 4 hours. No clinical signs were observed during the 14-day recovery period, and the body weight gains and findings after gross-pathological examination were normal. The 4-hour LC50 was > 6000 mg/m^3 (MAK, 2025).

Dermal

No data available

D. Irritation

Skin

In a skin irritation study in 6 rabbits with 24-hour occlusive application of undiluted 2-methoxy-1-propanol, maximum scores of 2 on a scale up to 4 for erythema on the intact and scarified skin and of 1 for oedema on the intact skin and of 2 on the scarified skin were given. The erythema was reversible after 8 days, and oedema formation after 72 hours. The primary irritation index was given as 1.7, and 2-methoxy-1-propanol was regarded as slightly irritating to the skin (MAK, 2025).

Eye

Acute eye irritation was investigated using undiluted 2-methoxy-1-propanol in 6 rabbits. A primary irritation index of 16.6 was obtained, and 2-methoxy-1-propanol was regarded as slightly irritating to the eyes (MAK, 2025).

E. Sensitisation

No data available

F. Repeated Dose Toxicity

Oral

2-methoxy-1-propanol was administered daily for 10 days by gavage to groups of 5 male Wistar rats in doses of 0 or 1800 mg/kg body weight. Apart from clinical observations, haematological parameters and the organ weights of the testes, thymus, liver, kidneys and spleen were determined. In addition, the testes and thymus were examined histopathologically. The body and organ weights as well as the gross-pathological findings were normal in the animals treated with 2-methoxy-1-propanol. The haemoglobin levels, erythrocyte count, haematocrit, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, and thrombocyte and leukocyte counts were significantly reduced in the animals treated with 2-ethoxyethanol. The haemoglobin levels (−8%) and erythrocyte count (−5%) were slightly but significantly reduced in the animals treated with 2-methoxy-1-propanol (MAK, 2025).

Inhalation

In a repeat dose inhalation study, sedation occurred in rats at concentrations of 2000 mL/m^3 and above, and irritation of the respiratory organs at a concentration of 3000 mL/m^3, and in rabbits reduced body weights and retarded body weight gains were observed at a concentration of 539 mL/m^3 (MAK, 2025).

Dermal

No data available

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on 2-methoxy-1-propanol are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on 2-methoxy-1-propanol

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial mutagenicity test (OECD 471)	-	-		MAK, 2025

*+, positive; -, negative

In Vivo Studies

No data available

H. Carcinogenicity

Oral

No data available

Inhalation

No long-term studies were identified with the pure substance.

In a chronic toxicity study, rats and mice were exposed to a commercial product that contained 2.46-2.59% 2-methoxypropanol by inhalation for 2 years. Exposure was estimated to be 281-292 mg 2-methoxypropanol/m^3). There was a significant increase in kidney adenomas in male rats, which was associated with 2u-globulin nephropathy (Health Canada, 2009).

Dermal

No data available

I. Reproductive Toxicity

No reproductive toxicity studies involving exposure to 2-methoxypropanol were identified.

In a three-generation study, rats were administered a commercial product that contained 0.5-1.5% 2-methoxypropanol. Exposure was through the drinking water during the gametogenesis cycle (64 days for males and 15 days for females). Sperm counts in epididymis decreased significantly in the first generation as the proportion of 2-methoxypropanol in the test substance increased. No significant effects were observed in epididymis or testes in the subsequent two generations. No variations in estradiol or testosterone concentration were observed in the first and second generations. No further analyses on the female reproductive system were performed in the study. A NOAEL for 2-methoxypropanol of 11.5 mg/kg-bw per day was identified for testicular toxicity (Health Canada, 2009).

In another reproductive toxicity study, male and female rats were administered 1800 mg 2-methoxypropanol/kg-bw per day or 2600 mg 2-methoxypropanol acetate/kg-bw per day (equivalent to 1772 mg 2-methoxypropanol/kg-bw per day) via gavage for 10 days. Haematological effects, evidenced by marginal reduction in red blood cell counts and total haemoglobin concentration, but without bone marrow damage, were observed (Health Canada, 2009).

J. Developmental Toxicity

Oral

No oral developmental toxicity data was identified.

A developmental toxicity study was conducted with 2-methoxypropanoic acid, a metabolite of 2-methoxypropanol. Pregnant rabbits were administered 2-methoxypropanoic acid via gavage during gestation days 7-19, followed by evaluation on day 28. Significantly increased foetal resorption and incidence of foetal variations and malformations, such as missing ribs, delayed ossifications, retrocaval ureter and paraovarian cyst, were observed at 78 mg 2-methoxypropanoic acid/kg-bw per day (equivalent to 67.6 mg 2-methoxypropanol/kg-bw per day, based on same molar amount conversion), with a NOAEL of 26 mg/kg-bw per day (equivalent to 22.5 mg 2-methoxypropanol/kg-bw per day). It was assumed that 100% of the 2-methoxypropanol in the blood was converted to 2-methoxypropanoic acid (Health Canada, 2009).

Inhalation

In developmental toxicity study, rabbits were exposed via inhalation to 2-methoxypropanol during the organogenesis period. In this study, dose-related, significantly increased foetal resorption and incidence of foetal visceral and skeletal malformations/variations and significantly reduced foetal body weights were observed at 225 parts per million (ppm) (843 mg/m^3) and above, in the absence of maternal toxicity. No exposure-related effects were observed at 145 ppm (543 mg/m^3), the no-

observed-effect concentration (NOEC). Maternal toxicity, evidenced by significantly reduced body weights and increased absolute placental weights, was observed at 545 ppm (2040 mg/m^3). Although significantly decreased absolute uterine weights were observed at lower concentrations, it was concluded to be partially related to the low number and weights of foetuses (Health Canada, 2009).

In another developmental toxicity study, pregnant rats were exposed to higher concentrations of 2-methoxypropanol (1000-3000 ppm, equivalent to 3745-11 235 mg/m^3). This resulted in the foetuses developing thoracic vertebral incisions and split vertebrae (Health Canada, 2009).

Developmental toxicity studies with 2-methoxypropanol acetate, a read-across material, in pregnant rats and rabbits resulted in similar developmental effects. This included a significantly increase in foetal resorption, thoracic vertebral incision and split vertebrae (rats, at 2700 ppm, equivalent to 10 112 mg 2-methoxypropanol/m^3, the highest concentration tested), and malformations of sternum, paws, major blood vessels and heart (rabbits, at 550 ppm, equivalent to 2060 mg 2-methoxypropanol/m^3, the highest concentration tested). Effects in dams included significantly reduced maternal body weights, respiratory and eye irritation and sedation in rats (at 550 ppm and above) and slight but statistically significant reductions in maternal body weights in rabbits (at 550 ppm). Rabbits appeared to be more sensitive than rats; all foetuses of rabbits exposed to 550 ppm 2-methoxypropanol acetate showed severe cardiac and skeletal abnormalities, whereas rats exposed to 2700 ppm 2-methoxypropanol acetate showed only some skeletal variations. This species difference is potentially due to the slower excretion rate of 2-methoxypropanol or 2-methoxypropanol acetate in rabbits (Health Canada, 2009).

Based on the above studies, the European Commission has classified 2-methoxypropanol as a Category 2 substance with Risk Phrase R61 ("May cause harm to the unborn child") (Health Canada, 2009).

Dermal

No dermal developmental toxicity data was identified.

Dermal application of its acetate moiety, 2-methoxypropanol acetate, at doses up to 2000 mg/kg-bw per day during gestation days 6-18 did not elicit developmental or maternal toxicity in rabbits. However, it is recognized that the acetate may be absorbed through the skin to a lesser extent than 2-methoxypropanol (Health Canada, 2009).

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for 2-methoxy-1-propanol follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

The lowest NOAEL from these studies is 11.5 mg/kg bw/day based on a three-generation study conducted on rats. The NOAEL of 11.5 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 11.5 /(10 x 10 x 1 x 10 x 1) = 11.5/1000 = 0.0115 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.0115 x 70 x 0.1)/2 = 0.04 mg/L

B. Cancer

No carcinogenicity data are available. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

2-Methoxy-1-propanol is flammable. It does not exhibit the following physico-chemical properties:

- Explosivity
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

2-Methoxy-1-propanol is expected to have low acute and chronic toxicity to aquatic organisms. It is expected to have low acute toxicity to terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

No experimental studies are available. Table 3 lists the results of predicted acute aquatic toxicity studies conducted on 2-methoxy-1-propanol using QSAR.

Table 3: Predicted Acute Aquatic Toxicity Studies on 2-Methoxy-1-Propanol

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Pimephales promelas (Fathead minnow)	96-hr LC_{50}	4,998 – 183,537	-	Health Canada, 2009
Daphnia magna (Water flea)	48-hr EC_{50}	19,000	-	Health Canada, 2009

Note: MATC = maximum acceptable toxicant concentration

Chronic Studies

No experimental studies are available. Table 4 lists the results of predicted chronic aquatic toxicity studies conducted on 2-methoxy-1-propanol using QSAR.

Table 4: Chronic Aquatic Toxicity Studies on 2-Methoxy-1-Propanol

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Green algae	96-hr EC_{50}	7,153	-	Health Canada, 2009

Note: MATC = maximum acceptable toxicant concentration

C. Terrestrial Toxicity

No experimental studies are available. A predicted acute terrestrial toxicity study conducted on 2-methoxy-1-propanol using QSAR identified a 14-day LC_{50} of 3,242 mg/kg dw for earthworms (Health Canda, 2009).

D. Calculation of PNEC

The PNEC calculations for 2-methoxy-1-propanol follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (4,998 mg/L) and invertebrates (19,000 mg/L). EC_{50} values from long-term studies are available for algae (7,153 mg/L). On the basis that the data consists of short-term results from two trophic levels and long-term results from one trophic level, an assessment factor of 1000 has been applied to the reported EC_{50} of 7,153 mg/L for algae. The $PNEC_{water}$ is 7.2 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 4.6 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (0.82/1280) \times 1000 \times 7.2$
$= 4.61$ mg/kg

Where:

$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water}$ = 0.8 + [(0.2 x Kp_{sed})/1000 x BD_{solid}]
= 0.8 + [(0.2 x 0.04/1000 x 2400]
= 0.82 m^3/m^3

Where:

Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
Kp_{sed} = K_{oc} x f_{oc}
= 1 x 0.04
= 0.04 L/kg

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for 2-methoxy-1-propanol calculated from EPISUITE™ using the MCI is 1 L/kg.
F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are no experimental toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 0.1 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil}$ = (Kp_{soil}/BD_{soil}) x 1000 x $PNEC_{water}$
= (0.02/1500) x 1000 x 7.2
= 0.096 mg/kg

Where:

Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
Kp_{soil} = K_{oc} x f_{oc}
= 1 x 0.02
= 0.02 m^3/m^3

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for 2-methoxy-1-propanol calculated from EPISUITE™ using the MCI is 1 L/kg.
F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Based on read-across, 2-methoxy-1-propanol is readily biodegradable and thus does not meet the screening criteria for persistence.

Based on log K_{ow} value of - -0.49, 2-methoxy-1-propanol does not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on 2-methoxy-1-propanol are > 0.1 mg/L in algae. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies on 2-methoxy-1-propanol are > 1 mg/L in fish and invertebrates. Thus, 2-methoxy-1-propanol does not meet the criteria for toxicity.

The overall conclusion is that 2-methoxy-1-propanol is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Flammable Liquid – Category 3

Reproductive toxicity – category 1B

Specific target organ toxicity (single exposure) – category 3

Skin irritation – category 2

Eye Damage – category 1

B. Labelling

Danger

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Do not induce vomiting. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

There was not a workplace exposure standard for 2-methoxy-1-propanol in Australia. However, the maximum allowable concentration is 5.0 ppm.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

2-Methoxy-1-propanol is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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2-METHYLBUT-3-YN-2-OL

This dossier on 2-methylbut-3-yn-2-ol presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed cellulose in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to human health or the environment.[1] [2]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): 2-methylbut-3-yn-2-ol

CAS RN: 115-19-5

Molecular formula: C_5H_8O

Molecular weight: 84.116 g/mol

Synonyms: 3-Butyn-2-ol, 2-methyl-; 2-methyl-3-butyn-2-ol; (1-hydroxy-1-methylethyl)acetylene

SMILES: CC(C)(O)C#C

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of 2-methylbut-3-yn-2-ol

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Clear colourless liquid	1	ECHA
Melting Point	3°C @ 101.3 kPa	2	ECHA
Boiling Point	104.26°C @ 101.3 kPa	2	ECHA
Density	860 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	2000 Pa @ 20°C	2	ECHA
Partition Coefficient (log K_{ow})	0.318 @ 25°C	2	ECHA
Water Solubility	1,000 g/L @ 20°C	2	ECHA
Flash Point	19°C	1	ECHA
Auto flammability	380°C	2	ECHA

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=8575433e-f36b-1410-8c14-0026b2c59b62
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=125a433e-f36b-1410-8924-008e64e216c7

Property	Value	Klimisch Score	Reference
Viscosity	3.64 mPa s @ 20°C	1	ECHA
Henry's Law Constant	0.1 Pa m^3/mol@ 25°C	2	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

2-Methylbut-3-yn-2-ol is not readily biodegradable. It is not expected to strongly adsorb to soil, sediment or suspended solids. It has a low potential for bioaccumulation.

B. Biodegradation

The results of an OECD Guideline 301 F (Ready Biodegradability: Manometric Respirometry Test) determined 2-methylbut-3-yn-2-ol is considered as poorly biodegradable. After prolonged test duration no biodegradation was observed (ECHA). [Kl. Score = 2].

If a chemical is found to be not readily or inherently biodegradable, it is categorised as Persistent since its half-life is substantially greater than 60 days (DoEE, 2017).

C. Environmental Distribution

No experimental studies are available for 2-methylbut-3-yn-2-ol. As calculated using SRC KOCWIN v2.00, the soil organic carbon partition coefficient (K_{oc}) for 2-methylbut-3-yn-2-ol is 4.138 L/Kg (corrected log K_{oc} = 0.62 L/kg) (ECHA). [Kl. Score = 2].

Based on this K_{oc} value, if released to soil, the substance is not expected to strongly adsorb to soil and will have very high mobility. If released to water, based on its Koc value and high water solubility, the substance is expected to preferentially partition to the aqueous phase.

D. Bioaccumulation

Based on a measured log K_{ow} of 0.318, bioaccumulation in organisms is not expected (ECHA).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

2-Methylbut-3-yn-2-ol is miscible with water and significant accumulation in biological tissues is not expected. It can be assumed that this material will be absorbed via the gastrointestinal tract and the respiratory tract. In acute oral, inhalation and dermal toxicity studies, 2-methylbut-3-yn-2-ol was shown to be moderately toxic. This material was not irritating to the skin and is not a skin sensitiser. It is an eye irritant. Following repeated-dose oral exposure, 2-methylbut-3-yn-2-ol caused systemic toxicity but was not a reproductive or developmental toxicant and is not genotoxic.

B. Metabolism

2-Methylbut-3-yn-2-ol is miscible with water. Based on the partition coefficient (log K_{ow}) of 0.318, significant accumulation in biological tissues is not expected (ECHA).

No studies analysing kinetics and metabolism are available. However, from the toxicity studies, it can be assumed that 2-methylbut-3-yn-2-ol will be absorbed via the gastrointestinal tract and the respiratory tract (ECHA).

C. Acute Toxicity

Oral

In an Acute Oral Toxicity study conducted in accordance with OECD 401, male and female rats were exposed to 172, 1076, 1377 or, 1722 mg/kg bw by oral gavage. The animals were then observed for 7 days for signs of toxicity. At the highest dose (1722 mg/kg bw), all animals died within 7 days and 4/10 died in the 1377 mg/kg bw group. There was only one death in the 1076 mg/kg bw group and no deaths in the low dose group. The LD50 was determined to be 1420 mg/kg bw (ECHA). [Kl. Score=2](ECHA).

Inhalation

In an Acute Inhalation Toxicity study conducted in accordance with OECD 403, male and female Wistar rats were exposed whole body to 21.3 mg/L 2-methylbut-3-yn-2-ol vapor for 4 hours. The animals were then observed for 14 days for signs of toxicity. No deaths occurred and no gross pathology findings. The LC50 was determined to be >21, 300 mg/m^3 (ECHA). [Kl. Score=1]

Dermal

In an Acute Dermal Toxicity study conducted in accordance with OECD 402, male Vienna White rabbits were exposed to undiluted 2-methylbut-3-yn-2-ol. The animals were exposed for 24 hours and then observed for 9 days for signs of toxicity. The LD50 was 172 mg/kg bw (ECHA). [Kl. Score=2]

D. Irritation

Skin

Acute Dermal Irritation potential of 2-methylbut-3-yn-2-ol was assessed in accordance with OECD 404 guidelines. Vienna White rabbits were administered undiluted test material to shave skin for up to 20 hours under occlusive conditions. The animals were then observed for 5 days for signs of toxicity. Under the conditions of this study, 2-methylbut-3-yn-2-ol was not irritating (ECHA). [Kl. Score=2]

Eye

2-Methylbut-3-yn-2-ol was found to be severe irritant to eyes, when 50 µl were instilled into the eyes of two Vienna White rabbits. Evaluation scores for corneal opacity, chemosis and conjunctival erythema were 2.16, 1 and 2, respectively. Thereby, the observed effects including staphyloma formation were not reversible within the eight-day observation period (ECHA). [Kl. Score = 2]

E. Sensitisation

In a skin sensitisation study, male guinea pigs were administered 4 applications of 100% 2-methylbut-3-yn-2-ol during the induction (for 10 days) and 3 applications of 100% of the material during the challenge (for 48 hrs). In addition to exposure to the material during induction, the

animals were administered 3 applications of Freund's adjuvant intradermally. Under the conditions of this study, there were no indication of skin sensitisation (ECHA). [Kl. Score=2]

F. Repeated Dose Toxicity

Oral

A Repeated-dose 90-day Oral Toxicity Study was conducted in accordance with OECD 408 guidelines. Male and female Wistar rats were administered 2-methylbut-3-yn-2-ol by gavage at 45, 130, or 400 mg/kg bw/day for 3 months. 2-Methylbut-3-yn-2-ol caused signs of systemic toxicity manifested on kidney as well as reproductive organs epididymis, testis, and ovary. These findings had been observed largely in the highest dose level tested (400 mg/kg bw/d). However, findings in the kidney of the male animals (macroscopic: enlarged and discoloured, histological correlate: increased eosinophilic droplets) were also partially present at mid dose levels (130 mg/kg bw/d). Therefore, under the conditions of the study the no observed adverse effect level (NOAEL) was 45 mg/kg bw/d for male Wistar rats (NOAEL for female Wistar rats = 130 mg/kg bw/d) (ECHA). [Kl. Score=1]

Inhalation

No data available

Dermal

No data available

G. Genotoxicity

2-Methylbut-3-yn-2-ol is not genotoxic.

In Vitro Studies

The *in vitro* genotoxicity studies on 2-methylbut-3-yn-2-ol are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on **2-Methylbut-3-yn-2-ol**

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial Reverse Mutation Assay (OECD 471)	-	-	2	ECHA
Mammalian Cell Gene Mutation Test (OECD 476)	-	-	1	ECHA

*+, positive; -, negative

In Vivo Studies

In an OECD 474 (Mammalian Erythrocyte Micronucleus Test) study, male and female NMRI mice (5 animals per sex per dose) were administered 300, 600, or 1200 mg/kg bw 2-methylbut-3-yn-2-ol by IP. After 24 – 48 hours of exposure, the animals were sacrificed and polychromatic and nonmonochromatic erythrocytes of bone marrow was examined. Under the experimental conditions chosen here, 2-methylbut-3-yn-2-ol had no chromosome-damaging (clastogenic) effect nor does it lead to any impairment of chromosome distribution during mitosis (ECHA). [Kl. Score=1]

H. Carcinogenicity

Oral

No studies are available. 2 -Methylbut-3-yn-2-ol did not induce mutations in bacteria or mammalian cells with or without addition of a metabolic activation system. No clastogenic activity was detected in an in vivo micronucleus assay. Based on the available genotoxicity data, there is no hint for any carcinogenic potential (ECHA).

Inhalation

No data available

Dermal

No data available

I. Reproductive Toxicity

A Repeated-dose 90-day Oral Toxicity Study was conducted in accordance with OECD 408 guidelines. Male and female Wistar rats were administered 2-methylbut-3-yn-2-ol by gavage at 45, 130, or 400 mg/kg bw/day for 3 months. 2-Methylbut-3-yn-2-ol caused signs of systemic toxicity manifested on kidney as well as reproductive organs epididymis, testis, and ovary. These findings had been observed largely in the highest dose level tested (400 mg/kg bw/d). However, findings in the kidney of the male animals (macroscopic: enlarged and discoloured, histological correlate: increased eosinophilic droplets) were also partially present at mid dose levels (130 mg/kg bw/d). Therefore, under the conditions of the study the reproductive NOAEL for female Wistar rats is 130 mg/kg bw/d (ECHA). [Kl. Score=1]

J. Developmental Toxicity

Oral

Developmental toxicity was evaluated in a prenatal developmental toxicity study performed in compliance with OECD guideline 414. Under the conditions of this prenatal toxicity study, the oral administration (by gavage) of 2-methylbut-3-yn-2-ol elicited clear signs of maternal and developmental toxicity at 400 mg/kg body weight/day, but was not toxic to the adult females and their foetuses at 45 or 130 mg/kg body weight/day. There were, however, no indications for substance induced teratogenicity up to and including the high dose level (400 mg/kg body weight/day), as the accessory 14th and/or rudimentary cervical rib(s) in the foetuses are assessed as an embryotoxic effect representing a manifestation of a non-specific stress on the dams. Based on these results, the NOAEL for the dams and the foetal organism is 130 mg/kg bw/day . Thus, developmental toxicity occurred only in the presence of maternal toxicity (ECHA). [Kl. Score = 1]

Inhalation

No data available

Dermal

No data available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for 2-methylbut-3-yn-2-ol follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

~~Oral~~

The administration of 2-methylbut-3-yn-2-ol by gavage to male and female Wistar rats for 3 months caused signs of systemic toxicity to the kidneys of male rats at doses greater than 45 mg/kg bw/d. The NOAEL of 45 mg/kg bw/day from the subchronic repeat dose study will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 45/ (10 x 10 x 1 x 10 x 1) = 45/1000 = 0.045 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.045 x 70 x 0.1)/2 = 0.16 mg/L

B. Cancer

2 -Methylbut-3-yn-2-ol did not induce mutations in bacteria or mammalian cells with or without addition of a metabolic activation system. No clastogenic activity was detected in an in vivo micronucleus assay. Based on the available genotoxicity data, there is no hint for any carcinogenic potential. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

2-Methylbut-3-yn-2-ol is flammable. It does not exhibit the following other physico-chemical properties:

- Explosivity
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

2-Methylbut-3-yn-2-ol is expected to have low acute and chronic toxicity to aquatic organisms. No studies are available for terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on 2-methylbut-3-yn-2-ol.

Table 3: Acute Aquatic Toxicity Studies on 2-Methylbut-3-yn-2-ol

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Leuciscus idus (Golden orfe fish)	96-hr LC_{50}	3,400	2	ECHA
Dapnia magna (Water flea)	48-hr EC_{50}	500	2	ECHA
Desmodesmus subspicatus (Green alga)	72-hr EC_{50}	>500 (growth)	2	ECHA

Note: a.i. = active ingredient

Chronic Studies

No chronic studies are available.

C. Terrestrial Toxicity

No studies are available.

D. Calculation of PNEC

The PNEC calculations for 2-methylbut-3-yn-2-ol follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute $E(L)C_{50}$ values are available for fish (3,400 mg/L), invertebrates (500 mg/L), and algae (>500 mg/L). No chronic studies are available. On the basis that the data consists of short-term results from three trophic levels and no long-term results are available, an assessment factor of 1,000 has been applied to the lowest reported $E(L)C_{50}$ value of 500 mg/L for invertebrates. The $PNEC_{water}$ is 0.5 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 0.344 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (0.8794/1280) \times 1000 \times 0.5$
$= 0.344$ mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 0.16552/1000 \times 2400]$
$= 0.8794\ m^3/m^3$

Where:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
$= 4.138 \times 0.04$
$= 0.16552$ L/kg

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The estimated K_{oc} for 2-methylbut-3-yn-2-ol is 4.138 L/kg.
F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are no toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 0.0276 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
$= (0.08276/1500) \times 1000 \times 0.5$
$= 0.0276$ mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
$Kp_{soil} = K_{oc} \times f_{oc}$
$= 4.138 \times 0.02$
$= 0.08276\ m^3/m^3$

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The estimated K_{oc} for 2-methylbut-3-yn-2-ol is 4.138 L/kg.

F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

2-Methylbut-3-yn-2-ol is not readily biodegradable; and, thus does meet the screening criteria for persistence.

Based on a measured log K_{ow} of 0.318, bioaccumulation is not expected; thus, 2-methylbut-3-yn-2-ol does not meet the criteria for bioaccumulation.

No chronic aquatic toxicity studies are available for 2-methylbut-3-yn-2-ol. The acute $E(L)C_{50}$ values from the aquatic toxicity studies on fish, invertebrates and algae are > 1 mg/L. Thus, 2-methylbut-3-yn-2-ol does not meet the screening criteria for toxicity.

The overall conclusion is that 2-methylbut-3-yn-2-ol is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Flammable Liquid Category 2

Acute Toxicity Category 2 (Oral)

Eye Damage Category 1

B. Labelling

Danger

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

Immediately wash affected eyes for at least 15 minutes under running water with eyelids held open, consult an eye specialist..

Skin Contact

Wash thoroughly with soap and water.

Inhalation

Keep patient calm, remove to fresh air, seek medical attention.

Ingestion

Rinse mouth immediately and then drink plenty of water, seek medical attention.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, dry chemical.

Specific Exposure Hazards

Special hazards arising from the substance or mixture include nitrogen oxides, carbon oxides. The substances/groups of substances mentioned can be released in case of fire. Under certain conditions in case of fire other hazardous combustion products may be generated. Cool endangered containers with water-spray.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus and chemical-protective clothing.

C. Accidental Release Measures

Personal Precautions

Ensure adequate ventilation. Avoid all sources of ignition: heat, sparks, open flame. Avoid contact with the skin, eyes and clothing. Do not breathe vapour/aerosol/spray mists.

Environmental Precautions

Do not empty into drains.

Steps to be Taken if Material is Released or Spilled

For large amounts: Pump off product. For residues: Pick up with suitable absorbent material. Dispose of absorbed material in accordance with regulations.

D. Storage And Handling

General Handling

Ensure thorough ventilation of stores and work areas. Handle in accordance with good industrial hygiene and safety practice.

Storage

Conditions for safe storage, including any incompatibilities. Segregate from acids and bases. Further information on storage conditions: Containers should be stored tightly sealed in a dry place..

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

The workplace exposure standards for 2-methylbut-3-yn-2-ol in Australia is as follows: 3 mg/m^3 (occupational exposure limit).

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Consider the risk management measures as outlined in the exposure scenario.

Hand Protection: Suitable materials also with prolonged, direct contact (Recommended: Protective index 6, corresponding > 480 minutes of permeation time according to EN 374): butyl rubber (butyl) - 0.7 mm coating thickness fluoroelastomer (FKM) - 0.7 mm coating thickness. Manufacturer's directions for use should be observed because of great diversity of types..

Skin Protection: None.

Eye protection: Tightly fitting safety goggles (cage goggles) (e.g. EN 166) and face shield., Consider the risk management measures as outlined in the exposure scenario.

Other Precautions: General safety and hygiene measures. Handle in accordance with good industrial hygiene and safety practice. Avoid contact with the skin, eyes and clothing. Do not inhale gases/vapours/aerosols. Wearing of closed work clothing is required additionally to the stated personal protection equipment.

F. Transport Information

2-methylbut-3-yn-2-ol is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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2-METHYLPROPAN-2-OL

This dossier on 2-methylpropan-2-ol (also referred to as TBA) presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): 2-methylpropan-2-ol

CAS RN: 75-65-0

Molecular formula: $C_4H_{10}O$

Molecular weight: 74.122 g/mol

Synonyms: 2-propanol, 2-methyl-; 2-propanol, 2-methyl- (9CI); tert-butyl alcohol; tert-butanol; t-butanol; TBA

SMILES: CC(C)(C)O

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of TBA

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Clear colourless liquid with camphor-like odour	1	ECHA
Melting Point	20°C @ 101.3 kPa	2	ECHA
Boiling Point	20°C @ 101.3 kPa	2	ECHA
Density	790 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	5,413 Pa @ 25°C	2	ECHA
Partition Coefficient (log K_{ow})	0.32 @ 20°C	1	ECHA
Water Solubility	100 g/L @ 25°C	2	ECHA
Flash Point	15°C	2	ECHA
Auto flammability	470°C	2	ECHA
Viscosity	4.52 mPa s @ 20°C	1	ECHA
Henry's Law Constant	0.917 Pa m^3/mol (temperature not provided)		NCBI, 2026

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

TBA is inherently biodegradable and has a low potential for bioaccumulation. It is not expected to adsorb to soil, suspended solids or sediment.

B. Biodegradation

Several studies on ready biodegradability of TBA have been conducted with results varying from little or no degradation to 99% degradation. A subsequent inherent biodegradability study designed to prevent test material loss from volatilisation and using adapted inoculum proved that TBA is inherently biodegradable (ECHA). [KI Score = 1].

If a chemical is found to be readily or inherently biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

The soil organic carbon partition coefficient (K_{oc}) of TBA has been reported as 37 L/Kg (NCBI, 2026). Based on this K_{oc} value, if released to soil, the substance will have limited sorption to soil and high mobility.

If released to water, TBA is miscible in water and will partition mainly to the water compartment. Some volatilisation to the atmosphere from bodies of water can be anticipated (ECHA). [KI Score = 2].

D. Bioaccumulation

Based on a log K_{ow} value of 0.32 and a bioconcentration factor (BCF) of <5 in carp (NCBI, 2026), the potential for bioconcentration or bioaccumulation in aquatic organisms is low.

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

The biotransformation of TBA was investigated following oral administration (rats and human). The major metabolites identified in the urine of both species were 2-methyl-1,2-propanediol and 2-hydroxyisobutyrate. The dermal absorption of radiolabelled TBA was analysed and only a small amount was absorbed; the rest was rapidly cleared and excreted. Less than 1.5% of the applied dose was detected in the excreta and tissues. This material has a low potential for acute oral, dermal and inhalation toxicity. TBA is not considered a dermal irritant or sensitiser; however, it was considered an eye irritant. Repeated-dose toxicity studies reveal several systemic effects following oral exposures for 90-days and 2 years. This material is non-genotoxic in both *in vitro* and *in vivo* models and was not considered a reproductive or developmental toxicant or a carcinogen.

B. Metabolism

In several metabolism studies (OECD 417), the biotransformation of TBA was investigated following oral administration (rats and human). Rats were administered a single dose of either [12C]- or [13C]-TBA in corn oil by oral gavage. There was a qualitatively similar metabolic profile in both rats and human. The major metabolites identified in the urine of both species were 2-methyl-1,2-propanediol

and 2-hydroxyisobutyrate. Unconjugated TBA and TBA glucuronide were present as minor metabolites. Differences were also observed. In the rat, the presumed TBA sulphate was present as a major metabolite while in the human, only traces of the sulphate were present. [13C]-Acetone was also reported as a minor metabolite in rats while no acetone was reported in human urine (ECHA). [Kl. Score=2]

The dermal absorption of radiolabelled TBA was analysed. A single topical application of [14C]-TBA to Sprague-Dawley rats showed a low potential for dermal absorption and bioaccumulation. The small amount of test material that was absorbed was rapidly cleared and excreted. Less than 1.5% of the applied dose was detected in the excreta and tissues (1%) at all time points. Most of the dose (group means 84-89%) was retained in the carbon filters above the dose site (sampled at 1 hr), with an additional 1.1-1.2% retained in the filters between 1 and 6 hours. Radioactive volatile material was also trapped from the metabowl chambers, representing 4.4-8.4% and 0.5-0.6% at 1 and 6 hours, respectively. The nature of the radioactivity present in a pooled 1-hour NaOH trapping solution was consistent with [14C]-TBA. This was likely [14C]-TBA not retained by the carbon filters above the dose site. Very little dose was retained at the dose site. The concentration of radioactivity in the blood decreased from 3.25 µg eq/g at 6 hours to 0.76 µg eq/g at 72 hours. In this study, TBA showed a very low potential for dermal absorption in the rat. The very small proportion of dose that was absorbed was rapidly cleared from the site of application and excreted ECHA). [Kl. Score=2]

The pharmacokinetics of TBA was characterized in Fischer 344 rats. Tertiary butyl alcohol was administered through an intravenous right jugular vein cannula at dose levels of 37.5, 75, 150, and 300 mg/kg bw to 4 male and 3 female rats. Blood samples were withdrawn through the same cannula into heparinized syringes at 5, 10, 20, 30, 40 and 60 min and 4, 8, 12, 16 and 24 h after TBA administration. Data were fit to a two-compartment model resulting in a T½ (distribution) of approximately 3 minutes and a T½ (elimination) of approximately 3.8 hours for male and female rats administered doses less than 300 mg/kg bw TBA. After injection of 300 mg/kg bw TBA, the T½ (elimination) was increased to 5.0 hours in male and 4.3 hours in female rats. Values for the volume of the central compartment were approximately the volume of extracellular fluid; the volume of distribution at steady state was small; TBA clearance was slower than the glomerular filtration rate; systemic clearance significantly declined with increasing TBA doses in both sexes; and the area under the concentration-time curve (AUCo-∞) increased disproportionally, especially in male rats, with increasing TBA dose (ECHA). [Kl. Score=1]

C. Acute Toxicity

Oral

An acute oral toxicity test was conducted in accordance with EPA OPPTS 870.1100 guidelines. Male and female Sprague-Dawley rats were administered a single dose of 1950, 2535, 3296 or 4285 mg/kg bw of TBA by oral gavage. The animals were observed for 14 days for signs of toxicity. Clinical signs indicated reversible effects on the central nervous system included piloerection, ataxia, decreased limb tone, low carriage, prostration, impaired righting reflex, bradypnea, hypoactivity and lacrimation. Signs were generally dose dependent and occurred more frequently in the higher dose groups. The oral LD50 was 3384 mg/kg bw in male rats, 2743 mg/kg bw in female rats, and 3046 mg/kg bw for both sexes combined (ECHA). [Kl. Score=1]

Dermal

An acute dermal toxicity test was conducted in accordance with EPA OPPTS 870.1200 guidelines. Male and female New Zealand White rabbits were topically exposed (abraded skin) to a single dose 2000 mg/kg bw of TBA. The animals were exposed to the material for 24 hours and observed for 14

days for signs of toxicity. The only effects related to test substance administration were reversible central nervous system effects in all animals and injected iris in all males and four of five females. Under the conditions of this study, the dermal LD50 of TBA in male and female New Zealand White rabbits was > 2000 mg/kg bw (ECHA). [Kl. Score=1]

Inhalation

An acute inhalation study was conducted in a method similar to EPA OPPTS 870.1300 guidelines. Male and female Sprague-Dawley rats were exposed whole body to 10,000 ppm of TBA vapor for 4 hrs and observed for 14 days. One female was found dead on study Day 3. The principal signs observed during exposure were indicative of central nervous system depression and included dyspnoea and prostration in all animals. These same signs, along with generalized weakness, appeared in several animals of each sex during the post-exposure period but were fully reversible by study termination. Gross pathological effects observed at necropsy were limited to focal areas of redness on the lungs. Under the conditions of this study, the 4-hour inhalation LC50 of TBA in male and female Sprague-Dawley rats was greater than 10000 ppm (actual concentration) or 36,000 mg/m^3 (nominal concentration) (ECHA). [Kl. Score=1]

D. Irritation

Skin

In a primary dermal irritation study, young adult New Zealand white rabbits (3 males, 3 females) were dermally exposed to 2 mL of TBA for 24 hours. Test material (0.5 mL) was applied to each of 2 intact and 2 abraded sites for each rabbit. Animals were then observed for 72 hours. Irritation was scored by the method of Draize. No oedema was noted. The test material caused minimal erythema at 24 hours in some rabbits, but no signs of erythema or oedema were present at the 72-hour observation period. Tertiary butyl alcohol is not considered a dermal irritant in this study (ECHA). [Kl. Score=1]

Eye

In a primary eye irritation study, 0.1 mL of TBA (> 91% pure) was instilled into the eyes of young adult New Zealand Albino rabbits (4 males, 5 females). Of these, 3 had their eyes washed after treatment and 6 were unwashed. Animals were observed for 16 days (unwashed eyes) or 34 days (washed eyes). Irritation was scored by the method of Draize. For all six animals in the unwashed group, a positive response of corneal opacity ≥1 and conjunctival redness ≥2 calculated as the mean scores following grading at 24, 48 and 72 hours after instillation of the test material was observed. All effects in unwashed eyes were fully reversible in 16 days. For all three animals in the washed group, a positive response of corneal opacity ≥1 was observed. All animals were normal on day 22. Corneal effects were again observed in a single animal in the washed group on day 25 and these effects continued until study termination on day 34. Since the score for corneal effects (6.3) on day 25 was higher than the scores on day 13 (5.0), day 16 (5.0), day 19 (2.5) and day 22 (0), no conclusion can be drawn about the significance of the effects observed in this single animal. In this study, ≥91% TBA was an eye irritant (ECHA). [Kl. Score=1]

E. Sensitisation

Skin

In a Guinea Pig Maximization Test for skin sensitisation (OECD 406), a group of 20 female guinea pigs was exposed to undiluted TBA. Under the conditions of this study, a concentration of 100% TBA at challenge did not cause a sensitisation reaction after prior intradermal exposures of 1% and topical exposures of 100% TBA. TBA is not classified as a skin sensitiser (ECHA). [Kl. Score=1]

Respiratory

No data available

F. Repeated Dose Toxicity

Oral

In a 2-year chronic toxicity study, TBA was administered to male F344/N rats ad libitum in drinking water at dose levels of 0, 1.25, 2.5 and 5 mg/mL (and to female F344/N rats at dose levels of 0, 2.5, 5 and 10 mg/mL (60 animals per sex per dose) for 103 weeks. Survival was decreased at the mid- and high-dose levels in males (24% and 20% in the control and low-dose group versus 8% and 4% in the mid- and high-dose groups) while survival was decreased in females at the high-dose level only (34% versus 58% in control group). In males, final mean body weight was 24% less than controls in the high-dose group; low- and mid-dose groups were decreased 15% and 17%, respectively. In females, at the 15-month interim evaluation, necropsy body weight was significantly decreased in the 10 mg/mL group; final mean body weight was 21% lower than the control in the high dose group. In females, there was a statistically significant dose-related increase in absolute and relative kidney weights at all dose levels. There were no gross lesions. At the 15-month interim evaluation in males, incidences and severities of mineralization (type not specified) of the kidney were greater than controls in the mid- and high-dose groups, chronic progressive nephropathy was present in all males, and severity of nephropathy was slightly but not statistically significantly increased in all exposed groups. By study termination, severity of nephropathy was significantly increased in the high-dose group, incidences of linear papillary mineralization were significantly increased in all dose groups, and there was a dose-related increase in focal renal tubule hyperplasia in all dose groups. These results indicate that, in male rats, the kidney is the target organ for TBA repeated exposure toxicity. In females, microscopic lesions included chronic progressive nephropathy in all groups at 15-months with a statistically significant increase in severity in all exposed groups by the end of the study. Kidney transitional cell hyperplasia was also significantly increased in the high-dose group. These results indicate that, in female rats, the kidney is the target organ for TBA repeated exposure toxicity. The lowest observed adverse effect level (LOAEL) for systemic toxicity following oral treatment in male rats for 2 years was 1.25 mg/mL (95-111 mg/kg bw/day) based on greater incidence and severity of linear papillary mineralization in the kidneys in all treatment groups. The LOAEL for systemic toxicity following oral treatment in female rats for 2 years was 2.5 mg/mL (291 – 511 mg/kg bw/day) based on greater severity of chronic progressive nephropathy in all treatment groups (ECHA). [Kl. Score=1]

In a subchronic study, TBA was administered to B6C3F1 mice (10 animals/sex/dose) in drinking water ad libitum at dose levels of 0, 2.5, 5, 10, 20 and 40 mg/mL (equivalent to 350, 640, 1590, 6430, and 8210 mg/kg bw/day) for 13 weeks. Lethality was observed in both sexes at the 8210 mg/kg bw/day dose level. Significant weight gain depression was seen in high-dose females and in the 6430 and 8210 mg/kg bw/day male exposure groups. Clinical signs of CNS depression were present in both

sexes. Gross lesions at necropsy were limited to the urinary bladder in 6430 and 8210 mg/kg bw/day males. Microscopic lesions were hyperplasia of the transitional epithelium (8210 mg/kg bw/day males and females and 6430 mg/kg bw/day) and inflammation of the urinary bladder (8210 mg/kg bw/day males and females and 6430 mg/kg bw/day males). Kidney nephropathy was not observed in any of the exposure groups. The results indicate that, in mice, the urinary tract is the target organ for TBA toxicity and male mice are more sensitive to TBA than female mice. Based on the effects observed in the 13-week study, a dose level of 6430 mg/kg bw/day was selected as the high exposure level for a 2-yr study in mice. The 6430 mg/kg bw/day males in the 13-week study had a final mean body weight that was 86% of the control group, and minimal inflammation and transitional cell hyperplasia of the urinary bladder were observed in some of these males. The severity of these changes was not considered by the study directors to be sufficient to adversely affect survival in a 2-yr study. The no observed adverse effect level (NOAEL) following oral treatment of B6C3F1 mice with TBA for 13 weeks was 640 mg/kg bw/day in males based on CNS effects observed at 1590 mg/kg bw/day and 1590 mg/kg bw/day in females based on emaciation observed at 64320 mg/kg bw/day (ECHA). [Kl. Score=1]

Inhalation

In a subchronic inhalation toxicity study, TBA was administered to B6C3F1 mice (10 animals/sex/group) by inhalation exposure at 0, 134, 272, 542, 1080 and 2101 ppm for 6 hr/day, 5 days/wk for 13 weeks. Based on a single compound-related death and a marked increase in segmented neutrophil count. The NOAEL in male mice is 1080 ppm. Other than a decrease in final body weight and increase in relative liver weights, no effects were observed in female mice. In the absence of mortality, clinical signs, haematological effects or gross/microscopic effects, the NOAEL in female mice is 2101 ppm. Nephropathy observed in similarly exposed male rats was not observed in either sex of mice. Tertiary butyl alcohol had no adverse effects on reproductive endpoints in either sex (ECHA). [Kl. Score=1]

Dermal

No data available

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on TBA are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on TBA

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial Reverse Mutation Assay (OECD 471)	-	-	1	ECHA
Sister Chromatid Exchange Assay in Mammalian Cells (CHO cells) (OECD 479)	-	-	1	ECHA
Mammalian Chromosome Aberration Test (CHO cells) (OECD 473)	-	-	1	ECHA
Mammalian Cell Gene Mutation Test (mouse lymphoma L5178Y cells) (OECD 476)	-	-	1	ECHA

*+, positive; -, negative

In Vivo Studies

In a mammalian erythrocyte micronucleus test, groups of 10 male and 10 female mice were exposed to TBA ad libitum in drinking water for 13 weeks at dose levels of 0, 0.25, 0.5, 1.0, 2.0 and 4.0%. The positive control induced the appropriate response. In vivo, no statistically significant increase in the frequency of micronucleated NCEs was observed in male or female mice administered TBA in drinking water for 13 weeks. In addition, no effect on the percentage of PCEs in the total erythrocyte population was noted, an indication that TBA was not toxic to bone marrow cells. Tertiary butyl alcohol did not cause cytogenetic damage resulting in the formation of micronuclei in mouse peripheral erythrocytes when administered to male and female mice ad libitum in drinking water at concentrations up to 4% for 13 weeks (ECHA). [Kl. Score=1]

H. Carcinogenicity

Oral

The carcinogenic potential of TBA has been investigated in rat and mouse. Although there were tumors observed in both species, the tumors in rats were thought to occur via a rat-specific mode of action that was not relevant to humans, whereas the tumors in mice were considered of little potential concern to humans. No classification for carcinogenicity is warranted (ECHA).

In a 2-year chronic toxicity study, TBA was administered to male F344/N rats ad libitum in drinking water at dose levels of 0, 1.25, 2.5 and 5 mg/mL (and to female F344/N rats at dose levels of 0, 2.5, 5 and 10 mg/mL (60 animals per sex per dose) for 103 weeks. Survival was decreased at the mid- and high-dose levels in males (24% and 20% in the control and low-dose group versus 8% and 4% in the mid- and high-dose groups) while survival was decreased in females at the high-dose level only (34% versus 58% in control group). In males, final mean body weight was 24% less than controls in the high-dose group; low- and mid-dose groups were decreased 15% and 17%, respectively. In females, at the 15-month interim evaluation, necropsy body weight was significantly decreased in the 10 mg/mL group; final mean body weight was 21% lower than the control in the high dose group. In females, there was a statistically significant dose-related increase in absolute and relative kidney weights at all dose levels. There were no gross lesions. At the 15-month interim evaluation in males, incidences and severities of mineralization (type not specified) of the kidney were greater than controls in the mid- and high-dose groups, chronic progressive nephropathy was present in all males, and severity of nephropathy was slightly but not statistically significantly increased in all exposed groups. By study termination, severity of nephropathy was significantly increased in the high-dose group, incidences of linear papillary mineralization were significantly increased in all dose groups, and there was a dose-related increase in focal renal tubule hyperplasia in all dose groups. These results indicate that, in male rats, the kidney is the target organ for TBA repeated exposure toxicity. In females, microscopic lesions included chronic progressive nephropathy in all groups at 15-months with a statistically significant increase in severity in all exposed groups by the end of the study. Kidney transitional cell hyperplasia was also significantly increased in the high-dose group. These results indicate that, in female rats, the kidney is the target organ for TBA repeated exposure toxicity. The LOAEL for systemic toxicity following oral treatment in male rats for 2 years was 1.25 mg/mL (95-111 mg/kg bw/day) based on greater incidence and severity of linear papillary mineralization in the kidneys in all treatment groups. The LOAEL for systemic toxicity following oral treatment in female rats for 2 years was 2.5 mg/mL (291 – 511 mg/kg bw/day) based on greater severity of chronic progressive nephropathy in all treatment groups (ECHA). [Kl. Score=1]

In another 2-year chronic toxicity study, TBA was administered to male B6C3F1 mice (60 animals/dose) ad libitum in drinking water at dose levels of 0, 5, 10 and 20 mg/mL for 103 weeks. Survival was decreased at the high-dose level (28% survived to study termination versus 45%

in the control group). Mean body weight was decreased in the high-dose group and remained 5-10% lower than controls until the final 10 weeks of the study. There were no gross lesions. Incidences of thyroid follicular cell hyperplasia were statistically significantly increased in all groups and incidences of chronic inflammation and transitional epithelial cell hyperplasia of the bladder were increased in the high-dose group. There was no progression of the bladder hyperplasia to neoplasia. The incidence of follicular cell adenoma was marginally increased in the mid-dose group, and a single follicular cell carcinoma was found in one male in the high-dose group. These results indicate that, in male mice, the thyroid gland and bladder are target organs for TBA repeated exposure toxicity. The LOAEL for systemic toxicity following oral treatment of B6C3F1 male mice with TBA for 2 years was 5 mg/mL (equivalent to 479-729 mg/kg bw/day) based on a statistically significant increase in thyroid follicular cell hyperplasia in all treatment groups. The NOAEL in male mice for carcinogenicity was considered to be 479-729 mg/kg bw/day (ECHA). [Kl. Score=1]

Inhalation

No data available

Dermal

No data available

I. Reproductive Toxicity

Oral

In a reproduction/developmental toxicity screening study (OECD 421), TBA was administered to 12 Sprague-Dawley rats/sex/group by oral gavage at dose levels of 0, 64, 160, 400, and 1000 mg/kg bw/day for up to 63 days in males and from 4 weeks prior to mating through PND 21 in females. There were no adverse effects on any reproductive parameters including mating index, fertility index, pregnancy index, or gestation index. For dams receiving 1000 mg/kg bw/day TBA through gestation and lactation, there was a significant reduction in mean litter size, a decrease in the number of live born per pregnancy, an increase in the number of stillborn pups, increased pup mortality up to PND 4, and a decrease in mean pup body weight at birth which continued to weaning. At this dose level, mild to moderate transient systemic toxicity was observed in both sexes in the parental generation including reversible CNS effects such as lethargy and ataxia, and reduced feed consumption and weight gain. No significant toxicity was observed at any other dose level. The NOAEL for developmental/reproductive effects was 400 mg/kg bw/day. The NOAEL for overall toxicity was 160 mg/kg bw/day (ECHA). [Kl. Score=1]

Inhalation

In a two-generation reproductive toxicity study, read-across substance propane, 2-methoxy-2-methyl- was administered to Sprague-Dawley rats (25 animals/sex/group) by whole body inhalation at target concentrations of 0, 400, 3000 and 8000 ppm for 10 weeks prior to mating. Males continued exposure until delivery of the F1-litters. Females continued exposure during mating, gestation and lactation until weaning of the offspring. There were no adverse effects on any reproductive parameters including pregnancy rates, gestation days, and mating and fertility indices. Toxic effects including clinical signs of CNS depression, and reduced body weight and/or body weight gain were observed in the F0 and F1 parental generations at 3000 and 8000 ppm. Signs of developmental toxicity such as lowered body weight and body weight gains were observed in the F1 and F2 litters when parents were exposed to 3000 or 8000 ppm but adverse effects occurred only

in the presence of maternal toxicity. Propane, 2-methoxy-2-methyl- and its metabolite TBA are not considered to be reproductive or developmental toxicants (ECHA). [Kl. Score=1]

J. Developmental Toxicity

Oral

No additional data are available

Inhalation

No data available

Dermal

No data available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for TBA follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

The lowest NOAEL from these studies is 160 mg/kg bw/day based on overall toxicity in a combined reproductive / developmental toxicity study conducted on male/female rats. This NOAEL of 160 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 160/(10 x 10 x 1 x 10 x 1) = 160/1000 = 0.16 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.16 x 70 x 0.1)/2 = 0.56 mg/L

B. Cancer

In a 2-year drinking water study, TBA produced increases in rat kidney and mouse thyroid tumours. Mechanistic information indicates TBA is unlikely to pose a significant risk for the development of tumours in humans exposed to low levels of this chemical (ECHA). Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

TBA does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

TBA is expected to have low acute and chronic toxicity to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on TBA.

Table 3: Acute Aquatic Toxicity Studies on TBA

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Pimephales promelas (Fathead minnow fish)	96-hr LC_{50}	>961 a.i.	1	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	933	1	ECHA
Raphidocelis subcapitata (Green alga)	72-hr EC_{50}	>976 (growth)	1	ECHA

Note: a.i. = active ingredient

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on TBA.

Table 4: Chronic Aquatic Toxicity Studies on TBA

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Clarias Gariepinus (African catfish)	5-day NOEC	332	2	ECHA
Daphnia magna (Water flea)	21-day NOEC	100	1	ECHA
Raphidocelis subcapitata (Green alga)	96- hr NOEC	976 (growth, geometric mean)	1	ECHA

C. Terrestrial Toxicity

A two-week study with earthworms (*Eisenia fetida*) in artificial soil identified an acute LC_{50} of >1,000 milligrams per kilogram dry weight (mg/kg dw) and a chronic NOEC of 1,000 mg/kg dw based on mortality (ECHA) [KI. Score = 1].

D. Calculation of PNEC

The PNEC calculations for TBA follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (>961 mg/L), invertebrates (933 mg/L), and algae (>976 mg/L). NOEC values from long-term studies are available for fish (332 mg/L), invertebrates (100 mg/L) and algae (976 mg/L). On the basis that the data consists of short-term and long-term results from three trophic levels, an assessment factor of 10 has been applied to the lowest reported NOEC of 100 mg/L for invertebrates. The $PNEC_{water}$ is 10 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 11.8 mg/kg sediment wet weight.

The calculations are as follows:

$$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$$
$$= (1.5104/1280) \times 1000 \times 10$$
$$= 11.8 \text{ mg/kg}$$

Where:

$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)

BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]

$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$

= 0.8 + [(0.2 x 1.48/1000 x 2400]
= 1.5104 m^3/m^3

Where:

Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
= 37 x 0.04
= 1.48 L/kg

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for TBA is 37 L/kg (NCBI, 2026).
F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There is limited toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 4.93 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
= (0.74/1500) x 1000 x 10
= 4.93 mg/kg

Where:

Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
$Kp_{soil} = K_{oc} \times f_{oc}$
= 37 x 0.02
= 0.74 m^3/m^3

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for TBA is 37 L/kg (NCBI, 2026).
F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

TBA is inherently biodegradable and thus does not meet the screening criteria for persistence.

The measured K_{ow} for TBA is 0.32 and a BCF in carp was <5 L/Kg. Thus, TBA does not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on TBA are > 0.1 mg/L. The acute $E(L)C_{50}$ values from the aquatic toxicity studies on TBA are > 1 mg/L. Thus, TBA does not meet the criteria for toxicity.

The overall conclusion is that TBA is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Flammable Liquid Category 2

Acute Toxicity Category 4 (Inhalation)

Specific Target Organ Toxicity Category 3

Eye Irritant Category 2

B. Labelling

Danger

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing and seek immediate medical attention.

Skin Contact

Immediately flush affected area with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoe. If irritation persists get medical advice/attention.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention. Do not leave the victim unattended. Keep patient warm and at rest. Immediately seek medical attention. If breathing is difficult, give oxygen. If unconscious place in recovery position and seek medical advice. In the event of unconsciousness, apnea or cardiac arrest (no pulse) apply cardiopulmonary resuscitation.

Ingestion

Clean mouth with water and drink afterwards plenty of water. Do not induce vomiting. Do not give milk or alcoholic beverages. Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person. If vomiting does occur, have victim lean forward to reduce risk of aspiration.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, alcohol-resistant foam, dry chemical.

Specific Exposure Hazards

Flash point is less than freeze point. When mixed with air and exposed to ignition source, vapours can burn in open or explode if confined. Heat/contamination can release extremely flammable isobutylene gas. Diluting with water may not suffice to raise flash point above ambient temperatures. Vapours may be heavier than air. May travel long distances along the ground before igniting and flashing back to vapor source. Move containers from fire area if you can do it without risk. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Blanket with alcohol–resistant foam. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. Always stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn..

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus. Structural firefighters protective clothing will only provide limited protection.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas. If the product contaminates rivers and lakes or drains inform respective authorities.

Steps to be Taken if Material is Released or Spilled

Extremely flammable liquid/frozen form may also be highly flammable; Eliminate all sources of ignition. All equipment used when handling this product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. A vapor suppressing foam may be used to reduce vapours. Use clean non-sparking tools to collect absorbed material. Water spray may reduce vapor; but may not prevent ignition in closed spaces. Contain spillage, and then collect with

non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations.

D. Storage And Handling

General Handling

For industrial use only. Keep product and empty container away from heat and sources of ignition. Containers must be properly grounded before beginning transfer. Ensure adequate ventilation, especially in confined areas. Wear recommended personal protective equipment. Solate, vent, drain, wash and purge systems or equipment before maintenance or repair.

Storage

Store in tightly closed/properly vented containers away from heat/sparks/open flame and strong oxidizing agents/acids. Store closed steel drums with bung in up position. Vapor space above stored liquid may be flammable/explosive unless blanketed with inert gas. Protect from freezing. Electrical installations / working materials must comply with the technological safety standards. Keep container tightly closed and properly labelled. Store in a well-ventilated place. Keep container tightly closed. Do not store in aluminium. .

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard for TBA has not been established in Australia.

Engineering Controls

Both local exhaust and good general room ventilation must be provided not only to control exposure but also to prevent formation of flammable mixtures. Special attention should be given to low areas/pits where flammable vapours can accumulate..

Personal Protection Equipment

Respiratory Protection: Wear a respirator conforming to EN!40 with Type A filter or better.

Hand Protection: Wear chemical resistant gloves such as solvent-resistant gloves. The selected protective gloves have to satisfy the standard EN 374 derived from it. Before removing gloves clean them with soap and water..

Skin Protection: Depending on the conditions of use, protective gloves, apron, boots, head and face protection should be worn. The equipment must be cleaned thoroughly after each use. Choose body protection according to the amount and concentration of the dangerous substance at the work place.

Eye protection: Eye protection, including both chemical splash goggles and face shield, must be worn when the possibility exists for eye contact due to splashing/spraying liquid, airborne particles, or vapour. Wear tightly fitting safety goggles and ensure eye wash bottle with pure water is available.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

UN 1120, BUTANOLS (2-methylpropan-2-ol)

Class 3.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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2-PROPENAMID (IMPURITY)

This dossier on 2-Propenamid (impurity) (2PA) (CAS RN 79-06-1) presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): prop-2-enamide

CAS RN: 79-06-1

Molecular formula: C_3H_5NO

Molecular weight: 71.08 g/mol

Synonyms: 2-Propenamide; Acrylamide; Acrylamide solution 50%; EUROAMD

SMILES: C=CC(=O)N

II. PHYSICAL AND CHEMICAL PROPERTIES

Table 1: Overview of the Physico-chemical Properties of 2PA

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Crystalline White solid	1	ECHA
Melting Point	84.5°C at 101.3 kPa	1	ECHA
Boiling Point	Not applicable as substance is solid	1	ECHA
Density	1120 kg/m³ at 30°C	2	ECHA
Vapour Pressure	Not applicable as substance is solid	1	ECHA
Partition Coefficient (log K_{ow})	-0.9 at 20°C	1	ECHA
Water Solubility	2,155 g/L at 30°C	1	ECHA
Flash Point	Not applicable as substance is solid	1	ECHA
Auto flammability	Not applicable as substance is solid	1	ECHA
Viscosity	Not applicable as substance is solid	1	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

2-Propenamid is expected to biodegrade and is not expected to sorb substantially to soils or sediments based on the low log K_{ow} and K_{oc} values. In addition, 2-propenamid is not expected to bioaccumulate.

B. Biodegradation

2PA was found to degrade approximately 100% in 28 days in the OECD Closed Bottle Test (301D) (ECHA) [KI Score = 1].

C. Environmental Distribution

No data available (ECHA). However, K_{oc} values of 3.554 L/kg (K_{ow} method) and 5.694 L/kg (MCI method) were estimated using USEPA EPI Suite™ KOCWIN v2.00 module. The estimated log K_{oc} values equal 0.551 and 0.755 for the K_{ow} and MCI methods, respectively [KI Score = 2]. Based on these estimated values, the substance is not expected to sorb substantially to soils or sediments.

D. Bioaccumulation

No experimental data were available for bioaccumulation or bioconcentration of 2PA. However, the log bioaccumulation factor (BAF) determined from regression-based calculations were performed using EPI Suite BCFBAF v3.01. Based on a log K_{ow} of -0.67, the log BAF according to the Arnot-Gobas method for assessing bioaccumulation at the upper trophic level was determined to be -0.047 [KI Score = 2]. The relatively low log BAF suggests 2PA will not bioaccumulate to any substantial degree.

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

The acute toxicity of 2PA is low by the oral, inhalation and dermal routes. It is not irritating to the eyes or skin and is not a skin sensitiser. Repeated exposures of 2PA to rats in a chronic drinking water study exhibited neurotoxicity and carcinogenicity. *In vitro* and *in vivo* studies provide strong evidence that 2PA does not react directly with DNA. It has no reported reproductive or developmental effects.

B. Acute Toxicity

Oral

An EU Method B.1 (Acute Toxicity Oral) study was performed on Sprague-Dawley rats exposed to 2PA. Under the experimental conditions, the oral LD_{50} in rats of acrylamide in aqueous solution at 50% was 354 mg/kg in female rats with 95% confidence interval limits of 305-458 mg/kg. Toxicity was comparable in males. In accordance with the ethic and scientific recommendations concerning the LD_{50} a more precise determination was not conducted. Based on the results of this study, it can be concluded that the acute oral LD_{50} of acrylamide in rats is 177 mg/kg (ECHA) [KI score =1].

Inhalation

An OECD Guideline 433 draft (Acute Inhalation Toxicity: Fixed Concentration Procedure) was employed to estimate the acute inhalation toxicity of 2PA to an unspecified strain of male rat. The results of this test indicate that the 50.7% solution of acrylamide is practically non-toxic by the inhalation route with a LC_0 (60 mins) of 12 mg/L (ECHA) [KI score =2].

Dermal

An OECD Guideline 402 – Acute Dermal Toxicity was employed to estimate the acute dermal toxicity of 2PA to a non-specified strain of rabbit. Rabbits were occlusively dosed at 200, 795, 1,580 and 3,160 mg/kg of 50.7% aqueous acrylamide solution. Solution was applied to unabraided skin. The acute dermal LD_{50} for acrylamide was determined to be 1,141 mg acrylamide/kg bw (ECHA) [KI Score=1].

C. Irritation

Skin

An OECD Guideline 404 (Acute Dermal Irritation / Corrosion) was conducted to determine the skin irritation potential of 2PA using New Zealand White rabbits. Shaved areas of three male animals were treated with 0.5 g per animal of the test article prepared as a paste with 0.086 g of water. A semi-occlusive patch was overwrapped with a gauze binder and secured with tape for an exposure period of 4 hours. Post dosing, excess test article which had not penetrated was wiped away with a gauze pad moistened with water. Animals were observed for 1, 24, 48 and 72 hours after the removal of the bandage. Scoring was conducted according to the scale published in the OECD Guideline (No. 404 – 1992).

Neither erythema nor oedema was observed at any time. It can be concluded from the results obtained under the experimental conditions employed that acrylamide is not irritating to skin (ECHA) [KI score = 1].

Eye

An OECD Guideline 405 (Acute Eye Irritation / Corrosion) primary eye irritation study was performed using 2PA. Three male New Zealand White rabbits received 0.1 mL of undiluted solution in one eye. The other eye remained untreated. The exposure period was 24 hours. Reactions were scored at 1, 24, 48 and 72 hours and at 7, 14 and 21 days post-application to evaluate reversibility of the lesions.

Maximum conjunctivae, chemosis, iris and corneal opacity scores were 2, 2, 1 and 2.3, respectively, which were found to be fully reversible up to 21 days post exposure.

There were no deaths or remarkable body weight changes during the study period. Under the study conditions, 2PA is considered to cause irritation to the eye (ECHA) [KI score = 1].

D. Sensitisation

An OECD Guideline 406 (Skin Sensitisation) study (i.e., Buehler test) was performed on Pirbright-Hartley guinea pigs. Systemic toxic symptoms after application were not observed at any time during the study. Body weight development was positive and within normal ranges. No erythema nor oedema was observed at any point after the challenge application

in the control group. There were apparently no skin reactions in control animals but 85% of test animals gave a positive response. On the basis of these results, acrylamide should be considered a skin sensitiser in animals (ECHA) [KI score = 1].

E. Repeated Dose Toxicity

~~Oral~~

An OECD Guideline 453 (Combined Chronic Toxicity / Carcinogenicity Studies) was performed using Fischer 344 rats. 2PA was administered orally in drinking water for a period of two years. Dosing levels were given at 0.0, 0.01, 0.1, 0.5 and 2.0 mg/kg/day.

The rats were generally observed twice daily during the work week for overt signs of toxicity or changes in demeanour. These observations included the animals' movement within the cage, the availability of food and water, wastage of feed and the response to the opening and closing of the cage. Routine monitoring on weekends and holidays was limited to the removal of dead animals and animal husbandry procedures required to ensure the availability of food and water.

Parameters monitored during the study included mortality, body weight, food consumption, water consumption, clinical observations, haematology, clinical chemistry, urinalysis, organ weights, gross and histopathology. All rats were examined approximately monthly after the first month for palpable masses. Individual body weights were recorded monthly from all rats.

Overall, ingestion of 2PA induced neurotoxicity in F344 rats at doses ranging from 0.01-2.0 mg/kg/day. Testicular atrophy was observed in rats at elevated doses. The No Observed Adverse Effect Level (NOAEL) was determined to be 0.5 mg/kg in both sexes of rats (ECHA) [KI Score = 1].

Inhalation

No data were available.

Dermal

No data were available.

F. Genotoxicity

In Vitro Studies

The results of the *in vitro* genotoxicity studies on 2PA based are presented in Table 2.

Table 2: *In Vitro* Genotoxicity Studies on 2PA

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay) (Bacterial Reverse Mutation Assay)	-	-	2	ECHA

*+, positive; -, negative.

In Vivo Studies

Acrylamide has been extensively tested in a wide variety of *in vitro* and *in vivo* assays for detection of genetic effects. There is no compelling evidence that acrylamide induces point mutations or interacts with DNA *in vivo* to form DNA adducts. In contrast to point mutation and DNA damage assays, acrylamide induces a variety of chromosomal effects in bone marrow, but studies in spermatogonia are conflicting. Dominant lethal assays have generally produced positive results with acrylamide, which could be explained by chromosomal effects such as deletions. These studies, taken together, provide very strong evidence that acrylamide does not react directly with DNA (ECHA) [KI Score = 4].

G. Carcinogenicity

Oral

An OECD Guideline 453 (Combined Chronic Toxicity / Carcinogenicity Studies) was performed using Fischer 344 rats. 2PA was administered orally in drinking water for a period of two years. Dosing levels were given at 0.0, 0.01, 0.1, 0.5 and 2.0 mg/kg/day.

Overall, ingestion of 2PA induced benign thyroid, mammary gland and tunica vaginalis tumours. The NOAEL was determined to be 0.5 mg/kg in both sexes of rats (ECHA) [KI Score = 1].

Despite National Toxicology Program conclusions that long-term dosing studies using 2PA provide clear evidence of carcinogenicity in rats, the cited study results provided in this dossier are equivocal relative to cancer responses. When evaluating a human relevance table, none of these tumors appear relevant to humans. Humans have substantially different mammary gland physiology from rodents and the tunica vaginalis tumors appear specific for the F344 rat. Only the thyroid may have significance (ECHA).

It should be noted that according to National Industrial Chemicals Notification and Assessment Scheme (NICNAS, 2002) acrylamide meets the National Occupational Health and Safety Commission (NOHSC) Approved Criteria (NOHSC, 1999) for classification as a Category 2 carcinogen (Risk Phrase R45 – May cause cancer).

Inhalation

No studies are available.

Dermal

No studies are available.

H. Reproductive Toxicity

Oral

An OECD Guideline 416 (Two-Generation Reproduction Toxicity Study) was performed on male and female Fischer 344 rats. 2PA was administered orally in drinking water at 0, 0.5, 2.0 or 5.0 mg/kg/day.

Long-term exposure to 2PA in the drinking water, over two generations in Fischer 344 rats, resulted in parental toxicity (reduced bodyweight, clinical signs of toxicity, histologic evidence of axonal swelling and/or degeneration in peripheral nerves) at 5.0 mg/kg/day, accompanied by prenatal lethality. Exposure to 2.0 mg/kg/day resulted in similar but lesser adult toxicity but no prenatal lethality. Exposure to 2.0 mg/kg/day resulted in no change to reproductive parameters in either generation except for reduced body weights and weight gain in F0 males in the pre-breed exposure period and reduced body weight and weight gain in F0 females late in the pre-breed exposure period. The only significant reproductive event induced by 2PA was decreased litter size as a result of dominant lethal mutations.

The NOAEL for all generations was determined to be 2 mg/kg/day (ECHA) [Kl Score = 1].

I. Developmental Toxicity

An OECD Guideline 414 (Prenatal Developmental Toxicity Study) was performed on Sprague-Dawley rats. Animals were dosed daily via oral gavage at 0, 2.5, 7.5 and 15 mg/kg.

Maternal Effects

There were no maternal mortalities and no clear clinical signs of toxicity. When corrected for gravid uterine weight, maternal body weight gain was decreased amongst animals receiving 7.5 and 15 mg/kg/day. The NOAEL for maternal toxicity was determined to be 2.5 mg/kg bw/day.

Developmental Effects

There were no apparent effects on embryo/foetal viability, growth or malformations. There was a slight, but not statistically significant, increase in the incidence of skeletal variations. The most frequently observed variation was the presence of a rudimentary extra lumbar rib. This finding is considered likely to be an indirect consequence of maternal toxicity or stress and is of limited toxicological importance. The NOAEL for developmental effects was determined to be 15 mg/kg bw/day (ECHA) [Kl score = 1].

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for 2PA follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2021).

A. Non-Cancer

Oral

Based on health considerations, the concentration of acrylamide in drinking water should not exceed 0.0002 mg/L according to Australian Drinking Water Guidelines Version 3.4. The guideline value for acrylamide of 0.0002 mg/L is based on a consideration of health effects in relation to the limit of determination for analysis using commonly available techniques.

Based on strict health related factors, a health-based derivation was determined as 0.0007 mg/L according to Australian Drinking Water Guidelines Version 3.4. A safety factor of 1,000 is used for the results of an animal study as a basis for human exposure (10 for interspecies variations, 10 for intraspecies variations and 10 for a less than lifetime study). An additional factor of 10 for carcinogenicity was not applied as tumours occur at doses above those that cause neurotoxic effects. The use of this safety factor was recommended by the NHMRC Standing Committee on Toxicity.

B. Cancer

An oral cancer slope factor for 2PA of 5×10^{-1} per mg/kg/day has been developed by USEPA and presented in the Integrated Risk Information System (IRIS) based on thyroid tumours and tunica vaginalis mesotheliomas (USEPA). Health based values will not be derived based on the noted slope factor since NICNAS has determined that the above noted drinking water guidance value is protective of both non-cancer and cancer effects.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

2PA does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

2PA has low acute and chronic aquatic toxicity.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on 2PA.

Table 3: Acute Aquatic Toxicity Studies on 2PA[1]

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Onchorhyncus mykiss	96-hour LC_{50}	180	1	ECHA
Daphnia magna	48-hour EC_{50}	60	1	ECHA

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Pseudokirchneriella subcapitata	72-hour EC_{50}	33 (growth inhibition) 50 (growth rate inhibition)	2	ECHA

Chronic Studies

Fish: A 28-day study was conducted to determine the toxicity of acrylamide monomer to carp (*Cyprinus carpio*). Fish were exposed to 2PA at concentrations of 0, 0.05, 0.5 and 5 mg/L. The NOEC was determined to be 5 mg/L (ECHA) [KI Score = 2].

Invertebrates: No freshwater invertebrate chronic toxicity data were available (ECHA) [KI Score = 1].

C. Terrestrial Toxicity

No data were available.

D. Calculation of PNEC

The PNEC calculations for 2PA follow the methodology discussed in DEWHA (2009).

PNEC water

Experimental results are available for three trophic levels. Acute $E(L)C_{50}$ values are available for fish (180mg/L), Daphnia (60 mg/L), and algae (33 mg/L). NOEC values from long-term studies are available for fish (5 mg/L). On the basis that the data consists of short-term studies for three trophic levels and long-term studies from one trophic level, an assessment factor of 100 has been applied to the lowest reported NOEC value of 5 mg/L. Therefore, the $PNEC_{water}$ is 0.05 mg/L.

PNEC sediment

2PA is expected to degrade rapidly in the environment. Moreover, based on the low K_{ow} and K_{oc} values, the substance is not expected to bind substantially to sediment. Therefore, a PNEC for sediment has not been calculated.

PNEC soil

2PA is expected to degrade rapidly in the environment. Moreover, based on the low K_{ow} and K_{oc} values, the substance is not expected to bind substantially to soil. Therefore, a PNEC for soil has not been calculated.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

2PA is an organic substance that has been determined to be readily biodegradable. Thus, it does not meet the screening criteria for persistence.

The relatively low log BAF (-0.047) suggests 2PA will not bioaccumulate to any substantial degree. Therefore, 2PA does not meet the screening criterion for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on 2-PA are > 0.1 mg/L. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies on 2-PA are > 1 mg/L. Thus, 2-PA does not meet the criteria for toxicity.

Based on PBT assessment guidance cited above, 2PA is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Acute Toxicity [Oral] – Category 3

Acute Toxicity [Dermal] – Category 4

Acute Toxicity [Inhalation] – Category 4

Skin Irritation – Category 2

Eye Irritation – Category 2

Skin Sensitisation – Category 1

Reproductive toxicity – Category 2

Mutagenicity – Category 1B

Carcinogenicity – Category 1B

Specific Target Organ Toxicity, Repeated Exposure – Category 1

B. Signal word

Danger

C. Pictogram



X. SAFETY AND HANDLING

A. First Aid

Eye Contact

Immediately flush open eyes with plenty of water for at least 15 minutes. Remove contacts, if present and easy to do. Get medical attention immediately, preferably a physician for an ophthalmologic examination.

Skin Contact

For minor skin contact, avoid spreading material on unaffected skin. Remove and isolate contaminated clothing. Wash the contaminated area of body with soap and fresh water. Get medical attention. Launder contaminated clothing before reuse.

Inhalation

Move person to fresh air. Administer oxygen if breathing is difficult. Do not use mouth-to-mouth method if victim inhaled the substance; give artificial respiration with the air of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Give artificial respiration if victim is not breathing. Get medical attention immediately.

Ingestion

Do not induce vomiting. Get medical attention immediately.

Notes to Physician

All treatments should be based on observed signs and symptoms of distress in the patient.

B. Fire Fighting Information

Extinguishing Media

Use water spray or fog, foam, dry chemical or carbon dioxide.

Specific Exposure Hazards

Emits toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon dioxide, carbon monoxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus and chemical-protective clothing.

C. Accidental Release Measures

Personal Precautions

Isolate area. Keep unnecessary and unprotected personnel from entering the area. Use personal protective clothing. Ensure adequate ventilation. Wear respiratory protection if

ventilation is inadequate. Do not breath mist, vapours or spray. Avoid contact with skin, eyes and clothing. Eliminate all sources of ignition.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

Eliminate all sources of ignition. Pick up with suitable absorbent material and transfer to a container for chemical waste. For large amounts: dike spillage and pump off product into container for chemical waste. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep away from heat, sparks and flame. Avoid contact with eyes, skin and clothing. Avoid breathing vapour. Wash thoroughly after handling. Keep container closed. Use with adequate ventilation.

Storage

Keep container tightly closed. Store away from heat and light.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

The workplace exposure standards for 2-PA in Australia is 0.03 mg/m^3 as am 8-hour time weighted average (TWA). There is also a skin notation indicating that absorption through the skin may be significant source of exposure.

Engineering Controls

Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Personal Protection Equipment

Respiratory Protection: If workers are exposed to concentrations above the exposure limit, they must use appropriate, certified respirators. If there are no applicable exposure limit requirements or guidelines, use an approved respirator. Selection of air-purifying or positive pressure supplied-air will depend on the specific operation and the potential airborne concentration of the product. For emergency conditions, use an approved positive-pressure self-contained breathing apparatus. The following should be effective types of air-purifying respirators: organic vapour cartridge with a particulate pre-filter.

Hand Protection: Use gloves chemically resistant to this material. Consult the SDS for appropriate glove barrier materials.

Skin Protection: Use protective clothing chemically resistant to the material. Selection of specific items such as face shield, boots, apron or full body suit will depend on the task.

Eye Protection: Use chemical goggles.

Other Precautions: Wash hands, forearms and face thoroughly after handling chemical products; before eating, smoking and using the lavatory; and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

UN number: 2074 (Solid)

XI. DISPOSAL MANAGEMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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3,6-DIAZAOCTANETHYLENEDIAMIN

This dossier on 3,6-diazaoctanethylenediamin (also referred to as trientine) presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed trientine in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to the environment.[1]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): (2-aminoethyl)({2-[(2-aminoethyl)amino]ethyl})amine

CAS RN: 112-24-3

Molecular formula: $C_6H_{18}N_4$

Molecular weight: 146.234 g/mol

Synonyms: trientine; 3,6-diazaoctanethylenediamin; triethylenetetramine; 3,6-diazooctanethylenediamin; N,N'-bis(2-aminoethyl)ethane-1,2-diamine; triethylenetetramine; trientine

SMILES: NCCNCCNCCN

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of trientine

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Viscous, colourless to yellow liquid with an ammonia-like odour	2	ECHA
Melting Point	-20°C @ 101.3 kPa	1	ECHA
Boiling Point	274.6°C @ 101.3 kPa	2	ECHA
Density	975 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	0.346 Pa @ 20°C	1	ECHA
Partition Coefficient (log K_{ow})	<0.3 @ 23°C	1	ECHA
Water Solubility	>1,000 g/L @ 20°C	1	ECHA
Flash Point	146.5°C	1	ECHA

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=5988433e-f36b-1410-8c14-0026b2c59b62

Property	Value	Klimisch Score	Reference
Auto flammability	324°C	1	ECHA
Viscosity	26.8 mPa s @ 20°C	1	ECHA
Henry's Law Constant	0 Pa m^3/mol@ 25°C	2	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Trientine is not readily biodegradable. It is expected to strongly adsorb to soil, sediment and suspended solids. However, based on its high water solubility it is expected to partition to the water column. It has a low potential for bioaccumulation.

B. Biodegradation

No studies are available on trientine. In an OECD Guideline 301 D (Ready Biodegradability: Closed Bottle Test) using read-across substance triethylenetetramine (mixed isomers, CAS 90640-67-8), 0% degradation based on O_2 consumption was observed. The substance is not readily biodegradable (ECHA). [Kl. Score = 2].

If a chemical is found to be not readily or inherently biodegradable, it is categorised as Persistent since its half-life is substantially greater than 60 days (DoEE, 2017).

C. Environmental Distribution

The adsorption coefficient of trientine was determined according to OECD 106 under GLP conditions. The test was carried out on 3 different soils having different physico-chemical properties and organic carbon contents. The average log soil organic carbon partition coefficient (K_{oc}) was determined to be 3.5 L/Kg at 20 °C and the average K_{oc} was 3204 L/kg (ECHA). [Kl. Score = 1]. Based on this K_{oc} value, if released to soil, the substance is expected to strongly adsorb to soil and be slightly mobile. If released to water, based on its high water solubility, the substance is expected to preferentially partition to water.

D. Bioaccumulation

A GLP test was published by NITE and was carried out on *Cyprinus carpio* under flow-through conditions. The BCF was determined for two test concentrations (0.2 and 2 mg/L). The maximum BCF in the experiment was determined to be ≤ 5 L/kg. Therefore, significant bioaccumulation in aquatic organisms is not to be expected (ECHA). [Kl. Score = 2].

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Orally administered trientine in humans is absorbed through the digestive tract; most of it is readily converted into a metabolite which loses its ability to chelate copper and is then excreted into the urine. Trientine is a moderate acute oral and dermal toxicant. The material causes necrosis after a 15 min exposure and severely irritates the eye. It is a skin sensitiser. Repeated-dose oral toxicity studies demonstrated trientine's systemic toxicity potential. The substance is not genotoxic, carcinogenic or a reproductive/developmental toxicant.

B. Metabolism

Trientine concentrations in the serum and urine of two healthy adults who were given trientine orally were examined. No trientine peak was detected in the serum. The amount of trientine in the urine of the two adults was only 1.6 and 1.7% of the dose administered. However, a large unidentified peak appeared in the urine after oral administration. This peak was not observed in a mixture of trientine and control urine or in urine before trientine administration. When the urine after trientine administration was analysed after hydrolysis with HCl, the unidentified peak disappeared, while the trientine peak increased. These findings indicate that the substance which yielded the unidentified peak is a metabolite of trientine, suggesting that most of the trientine administered is metabolized and then excreted in the urine. No bioaccumulation potential based on study results. These findings suggest that orally administered trientine in human is absorbed through the digestive tract, but that most of it is readily converted into a metabolite which loses its ability to chelate copper and is then excreted into the urine (ECHA). [Kl. Score=2]

C. Acute Toxicity

Oral

The acute oral toxicity study with trientine was conducted according to OECD 401 guidelines. A test group consisting of 5 animals/sex was treated by single gavage application with an aqueous solution of the test substance (1000, 1470, or 2150 mg/kg bw. The animals were observed for mortality and for clinical symptoms of toxicity. At the end of the observation period of 14 days, the surviving animals were sacrificed for the purpose of necropsy; animals that died during the observations period also were subjected to necropsy. At 2150 mg/kg 2 males and 4 females died within 24 h; 1 further male died within 48 h. At 1470 mg/kg 1 male and 4 females died within 24 h; 1 further male died within 48 and 7 days, respectively. At 1000 mg/kg 1 male and female each died within 7 days. The LD50 value was estimated to be ca. 1400 mg/kg bw (ECHA). [Kl. Score=2]

Inhalation

An acute inhalation toxicity study was conducted in accordance to OECD 403 guidelines. Male and female rats were exposed to vapour saturated with trientine for 8 hours and observed for 7 days. No mortality was observed. Aside from initial escape attempts, no clinical signs were noted. The pathology showed no findings (ECHA). [Kl. Score=2]

Dermal

The acute dermal toxicity (OECD 402) of trientine was determined for Sprague-Dawley rats. The product was applied as a 50% solution in olive oil at a dosage of 400 mg/kg, and undiluted at dosages of 1000 and 2000 mg/kg, once for 24 hours to the shaved dorsal and flank skin (area approximately 3-9 cm^2). No mortality occurred at 400 and 1000 mg/kg bw, at 2000 mg/kg one male died within 24 h. The remaining animals of this group died within 48 h. The median LD50 was > 1000 mg/kg < 2000 mg/kg (ECHA). [Kl. Score=2]

D. Irritation

Skin

Trientine was examined undiluted for skin irritation. Two rabbits were treated for 1, 5, 15 min and 20 hours using occlusive conditions. After the application time (1, 5, 15 min) the skin was washed

and the effects were examined after 10 minutes, 1, 24, 48, 72 hours as well as after 8 days. After a 5 min exposure bleeding and at the end of the observation period after 8 days scale formation was observed. After a 15 min or 20 h exposure soft necrosis (24 h evaluation) was observed which turned into leathery necrosis at the end of the observation period. It was concluded that the test substance caused necrosis after a 15 min exposure (ECHA). [Kl. Score=2]

Eye

Eye irritation was tested in one female New Zealand White rabbit in accordance with OECD 405 guidelines. Trientine was applied undiluted to the eye for 1 second. The treated eye was not washed. Vocalisation occurred immediately after test article administration. Due to the extreme ocular scores observed, the study was terminated at the study director's discretion after the 1-hour observation period. Based upon the observations made in the Primary Eye Irritation study, test article was determined to be a severe irritant (ECHA). [Kl. Score=1]

E. Sensitisation

In an OECD 429 skin sensitisation study, groups of mice received 25 µL of trientine in vehicle or an equal volume of vehicle alone on the dorsum of both ears daily for 3 consecutive days. A further group of control animals was untreated (naive). Five days after the initiation of exposure, all mice received an intravenous injection of 250 µL of phosphate buffered saline (PBS) containing 2O µCi of 3H-methyl thymidine. Five hours later, mice were sacrificed and the draining auricular lymph nodes removed and pooled for each experimental group. The test substance possesses contact allergic potential (positive in die local lymph node assay) but failed to provoke significant cytokine production as judged by cytokine fingerprinting; however, lack of immunogenicity means that it is not possible to confirm a secure negative with respect to respiratory sensitising potential. It is considered a skin sensitiser (ECHA). [Kl. Score=2]

F. Repeated Dose Toxicity

Oral

No data is available for trientine. Read-across substance triethylenetetramine dihydrochloride, was administered orally to male and female F-344 rats for 4 or 8 weeks at dosages of 0, 100, 350 or 1200 mg/kg/day or for 26 weeks at dosages of 50, 175 or 600 mg/kg/day.

4 or 8-week study: Two males receiving 1200 mg/kg/day died during week 8 of treatment. In males receiving 1200 mg/kg/day during weeks 5 to 8 of treatment, body weight gain and food consumption were decreased and hunched posture and thin build were observed. During week 4 or 8 of treatment urinalysis revealed, for males receiving 100 mg/kg/day or animals receiving 350 mg/kg/day or more, increased electrolyte outputs possibly due to the hydrochloride nature of trientine-2HCl, with low plasma alkaline phosphatase activities evident in animals receiving 350 or 1200 mg/kg/day. After 4 and 8 weeks, and during 8 weeks of treatment, high lung weights and bronchiolar epithelium hypertrophy and broncho-alveolar pneumonia were recorded for animals receiving 1200 mg/kg/day, and submucosal acute inflammation within the glandular region of the stomach was recorded for males receiving 350 or 1200 mg/kg/day and in all treated female groups.

26-week study: One male receiving 175 mg/kg/day and three males receiving 600 mg/kg/day died, showing lung changes. The body weight gain of animals receiving 600 mg/kg/day was slightly decreased. Blood chemistry and urinalysis examinations showed changes similar to those indicated in the 4- or 8-week study. The low plasma copper concentrations seen in males receiving 600 mg/kg/day, the slightly low liver copper concentrations found in animals receiving 600 or 175

mg/kg/day and the high urinary copper concentrations found in all treated groups, are attributed to the pharmacological action of trientine-2HCl. Histopathology revealed a dosage-related incidence and severity of focal chronic interstitial pneumonitis accompanied by fibrosis of the alveolar walls in females receiving 175 mg/kg/day or more and all treated male groups, but no significant pathological changes in the stomach. Apart from the histological changes found in the lung, all the above changes were reversible. In conclusion, the no observed adverse effect level (NOAEL) of triethylenetetramine dihydrochloride in this 26-week study was 50 mg/kg/day for females and the lowest observed adverse effect level (LOAEL)/NOAEL was less than 50 mg/kg/day for males (equivalent to 33 mg/kg bw/day trientine) (ECHA). [Kl. Score=2]

Inhalation

No data available

Dermal

No data available

G. Genotoxicity

Based on the weight of evidence from negative *in vivo* genotoxicity studies, along with equivocal results from *in vitro* studies, trientine is not considered to be genotoxic (ECHA).

In Vitro Studies

The *in vitro* genotoxicity studies on trientine presents are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on trientine

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial Reverse Mutation Assay (OECD 471)	+	+	1	ECHA
Mammalian Cell Gene Mutation Test (OECD 476)	-	-	2	ECHA
Sister Chromatid Exchange (SCE) (OECD 479)	+	+	2	ECHA
Hepatocyte UDS test (OECD 482)	-	-	2	ECHA

*+, positive; -, negative

In Vivo Studies

Trientine was evaluated for potential clastogenic (chromosome-damaging) activity with the in vivo micronucleus test system employing both male and female Swiss-Webster mice. Five doses of trientine ranging from 434 mg/kg to 900 mg/kg were administered as a single intraperitoneal (i.p.) injection. The LD50 dose was calculated from the cumulative mortality observed during a three-day period after dosing. To select dose levels for the definitive micronucleus test, a combined LD50 value of approximately 740 mg/kg (651 to 877; 95% fiducial limits) was calculated by pooling the total number of deaths for males and females. For the definitive micronucleus test, doses of 185 mg/kg, 370 mg/kg and 600 mg/kg were tested with both male and female Swiss-Webster mice. Concurrent positive (trientine) and negative (water) control agents, administered by i.p, injection, were used to

demonstrate the reliability and sensitivity of the micronucleus test system. Results from the micronucleus determination demonstrated that trientine did not produce positive or dose-related increases in the incidence of micronuclei in peripheral blood polychromatic erythrocytes of the test animals at any of the sample periods tested. Data from the positive and negative control groups of animals demonstrated the appropriate responses for the animals in the test system consistent with a valid test. The absence of positive effects of trientine upon the incidence of micronuclei indicates that trientine does not possess clastogenic activity *in vivo* under the conditions of the micronucleus test system (ECHA). [Kl. Score=2]

H. Carcinogenicity

Oral

No data available

Inhalation

No data available

Dermal

The dermal carcinogenic potential (OECD 451) of trientine was assessed by applying 25 µl of a 5% (v/v) solution in deionized water to the backs of 50 male C3H/HeJ mice. A negative control group was dosed with deionized water. Both applications were performed three times a week until the death of the animals. No treatment-related skin tumours were observed in the groups treated with trientine or deionized water. A papilloma was observed on the upper lip of a trientine-treated mouse, but this was considered unrelated to treatment because of its location. One negative control mouse had a sebaceous adenoma of the skin of the thorax. No statistically significant difference in mortality rates was observed between the treated group and the water control group. trientine was not locally carcinogenic when applied to the skin of C3H/HeJ mice. The results of the present study indicated that trientine was not carcinogenic to the skin of C3H/HeJ male mice when applied as a 5% (v/v) solution in deionized water until the death of the animals (ECHA). [Kl. Score=2]

I. Reproductive Toxicity

No data available

J. Developmental Toxicity

Oral

In a Prenatal Developmental Toxicity study (OECD 414), timed-pregnant Sprague Dawley rats were treated with trientine by daily oral gavage on gestational days (GD) 6 up to and including day 15. Groups of 24 females each received triethylenetetramine formulated in distilled water applied at a volume of 10 ml/kg bw at dosages of 0, 75, 325 or 750 mg/kg bw per day. Regarding the vehicle control, food intake was slightly depressed in all dose groups during the second part of the treatment period. Body-weight gain appeared to be somewhat reduced in the experimental groups; however, when corrected body weights were evaluated no differences were observed. No other toxic signs were observed in the mothers. A significant increase in the average body weight of the live foetuses was recorded for the high-dose group in the main study. The gross inspection of the live foetuses did not reveal any finding either in the experimental groups or in the vehicle control. The skeletal assessment revealed instances of irregular sternebral ossification in the dose groups and in

the vehicle control. Concerning the status of skeletal maturation of the foetuses shortly before term, apart from a slightly raised number of still unossified calcanei in the high-dose group in the main study, no delay of ossification could be found for the experimental groups in comparison with the vehicle control. Thus, under the conditions of this study, trientine produced no maternal toxicity except for slightly reduced food intake and no developmental toxicity at any dosages employed (ECHA). [Kl. Score=2]

Inhalation

No data available

Dermal

In another OECD 414 Prenatal Developmental Toxicity study, timed-pregnant New Zealand White rabbits were treated with trientine by occluded cutaneous application on gestational days (GD) 6 through 18, six hours per day. Groups of 22 does each received triethylenetetramine formulated in deionized water and applied in a volume of 2.0 ml/animal (approximately 0.5 ml/kg) at dosages of 0.0, 5.0, 50.0 or 125.0 mg/kg/day. Clinical observations of all study animals were undertaken daily, and maternal body weights were measured on GD 0, 6, 12, 15, 18 and 29. In addition, daily observations of the dosing site of treated animals were recorded from the initiation of the treatment period and continued until the termination of the study. At scheduled necropsy on GD 29, does were evaluated for body weight, liver weight, lung and kidney weight (2), gravid uterine weight and status of implantation sites (i.e., resorptions, dead foetuses, live foetuses). Maternal blood and urine were evaluated for copper content. Live foetuses were dissected from the uterus, counted, weighed, examined for external, visceral and skeletal abnormalities and sexed internally. Maternal kidneys and liver sections were retained in fixative for possible subsequent histopathologic examination. Two does (9.1%) died at 125.0 mg/kg/day. Maternal toxicity was also indicated by a significant decrease in body weight gain (in the exposure period) at 125.0 mg/kg/day. Also, clinical observations indicated severe skin irritation at 50.0 and 125.0 mg/kg/day with some recovery in the post-dosing period, Slight irritation at the dosing site was observed at 5.0 mg/kg/day which was transient, with essentially total recovery after exposures ceased. There were no effects on maternal lung, kidney or liver weights (absolute or relative to body weight) or on gravid uterine weight. There were no differences among groups for maternal serum or urinary copper. There was no effect of treatment on number of ovarian corpora lutea, number of total, live, or non-viable implantations per litter, or percent preimplantation loss, percent live foetuses or sex ratio (% male foetuses). Foetal body weights per litter (males, females or total) were also unchanged across groups, There was no significant increase in the incidence of individual malformations or variations or of external, visceral, skeletal, or total (external, visceral, plus skeletal) malformations or variations by foetus or by litter in any triethylenetetramine exposed group relative to the vehicle control group. One finding, poorly ossified hyoid bone exhibited a decreased incidence at 125.0 mg/kg/day relative to that in the vehicle control group. Thus, under the conditions of this study, trientine produced maternal toxicity other than at the dosing site only at 125 mg/kg/day but no developmental toxicity at any dosages employed (ECHA). [Kl. Score=2]

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for trientine follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

~~Oral~~

A LOAEL of 33 mg/kg bw/day based on irreversible histopathological changes in the lung of rat was determined for trientine in a subchronic oral toxicity study. This LOAEL will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 10
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 50/(10 x 10 x 10 x 10 x 1) = 50/10000 =0.005 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.005 x 70 x 0.1)/2 = 0.018 mg/L

B. Cancer

Trientine is not genotoxic and was not carcinogenic to the skin in a dermal carcinogenicity study conducted on mice. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Trientine does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Trientine has low acute and chronic toxicity to aquatic organisms. No studies are available for terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on trientine.

Table 3: Acute Aquatic Toxicity Studies on Trientine

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Oryzias latipes (Japanese rice fish)	96-hr LC_{50}	>100	1	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	43.1	1	ECHA
Raphidocelis subcapitata (Green alga)	72-hr EC_{50}	30.854 (growth)	1	ECHA

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on trientine.

Table 4: Chronic Aquatic Toxicity Studies on Trientine

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Daphnia magna (Water flea)	21-day EC_{10}	1.75	1	ECHA
Raphidocelis subcapitata (Green alga)	72-hr EC_{10}	2.385 (growth)	1	ECHA

C. Terrestrial Toxicity

No studies are available.

D. Calculation of PNEC

The PNEC calculations for trientine follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (>100 mg/L), invertebrates (43.1 mg/L), and algae (30.854 mg/L). NOEC values from long-term studies from two trophic levels are available for invertebrates (1.75 mg/L) and algae (2.385 mg/L). On the basis that the data consists of short-term results from three trophic levels and long-term

results from two trophic levels, an assessment factor of 100 has been applied to the lowest reported NOEC of 1.75 mg/L for invertebrates. The $PNEC_{water}$ is 0.0175 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 0.852 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (62.32/1280) \times 1000 \times 0.0175$
$= 0.852$ mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 128.16/1000 \times 2400]$
$= 62.32\ m^3/m^3$

Where:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
$= 3,204 \times 0.04$
$= 128.16$ L/kg

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). Based on experimental studies, the K_{oc} for trientine is 3,204 L/kg.
F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are no toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 0.7476 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
$= (64.08/1500) \times 1000 \times 0.0175$
$= 0.7476$ mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
$Kp_{soil} = K_{oc} \times f_{oc}$
$= 3,204 \times 0.02$
$= 64.08\ m^3/m^3$

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). Based on experimental studies, the K_{oc} for trientine is 3,204 L/kg.

F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Trientine is not readily biodegradable and thus does meet the screening criteria for persistence.

The measured BCF in fish is <5. Thus, trientine does not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on trientine in invertebrates and algae are > 0.1 mg/L. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies in fish, invertebrates and algae on trientine are > 1 mg/L. Thus, trientine does not meet the criteria for toxicity.

The overall conclusion is that trientine is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Acute Toxicity Category 4 (Dermal)

Skin Corrosion Category 1B

Skin Sensitiser Category 1

Aquatic Chronic Toxicity Category 3

B. Labelling

Danger

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

Immediately wash affected eyes for at least 15 minutes under running water with eyelids held open, consult an eye specialist.

Skin Contact

Immediately wash thoroughly with plenty of water, apply sterile dressings, consult a skin specialist.

Inhalation

Keep patient calm, remove to fresh air, seek medical attention. Immediately administer a corticosteroid from a controlled/metered dose inhaler..

Ingestion

Do not induce vomiting. Immediately rinse mouth and then drink 200-300 ml of water, seek medical attention.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, dry chemical.

Specific Exposure Hazards

Endangering substances: nitrogen oxides and carbon oxides. The substances/groups of substances mentioned can be released in case of fire. Under certain conditions in case of fire other hazardous combustion products may be generated.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus and chemical-protective clothing.

C. Accidental Release Measures

Personal Precautions

Avoid contact with skin and eyes. Take off immediately all contaminated clothing. Keep unprotected persons away. Use personal protective clothing. Ensure adequate ventilation. Avoid inhalation.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For small amounts: Pick up with absorbent material (e.g. sand, sawdust, general-purpose binder). For large amounts: Pick up with suitable appliance and dispose of. Incinerate or take to a special waste disposal site in accordance with local authority regulations. Clean contaminated floors and

objects thoroughly with water and detergents, observing environmental regulations. Collect waste in suitable containers, which can be labelled and sealed.

D. Storage And Handling

General Handling

Ensure thorough ventilation of stores and work areas. Handle in accordance with good industrial hygiene and safety practice. When using do not eat, drink or smoke. Hands and/or face should be washed before breaks and at the end of the shift.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard for trientine has not been established in Australia.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Breathing protection if gases/vapours are formed. Gas filter for gases/vapours of organic compounds (boiling point >65 °C, e. g. EN 14387 Type A).

Hand Protection: Wear chemical resistant protective gloves (EN ISO 374-1) with performance level 6, corresponding to a breakthrough time of >480 min according to EN ISO 374-1. .

Skin Protection: A chemical-protection suit (f.e. according to EN 14605) should be worn..

Eye protection: Tightly fitting safety goggles (cage goggles) (e.g. EN 166) and face shield.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Trientine is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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GLYCEROL MONOOLEATE
MONOPROPYLENE GLYCOL MONOOLEATE

This dossier on glycerol monooleate and monopropylene glycol monooleate presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed glycerol monooleate in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to human health and the environment.[1] [2] Likewise, monopropylene glycol monooleate was concluded as posing no unreasonable risk to human health.[3]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): 9-Octadecenoic acid (Z)-, monoester with 1,2,3-propanetriol

CAS RN: 25496-72-4

Molecular formula: $C_{21}H_{40}O_4$

Molecular weight: 356.5 g/mol

Synonyms: Glyceryl monooleate; monoglyceryl oleate; olicine

SMILES: O=C(OCC(O)CO)CCCCCCCC=CCCCCCCCC

Chemical Name (IUPAC): 9-Octadecenoic acid (9Z)-, monoester with 1,2-propanediol

CAS RN: 1330-80-9

Molecular formula: $C_{21}H_{40}O_3$

Molecular weight: 340.548 g/mol

Synonyms: monopropylene glycol monooleate; propylene glycol monooleate; oleic acid, ester with 1,2-propanediol

SMILES: O=C(OCC(O)C)CCCCCCCC=CCCCCCCCC

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=9f4d433e-f36b-1410-8924-008e64e216c7
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=4066433e-f36b-1410-8924-008e64e216c7
[3] https://services.industrialchemicals.gov.au/assessment-detail/?id=a2ae433e-f36b-1410-8de4-00e8f2afc108

II. PHYSICO-CHEMICAL PROPERTIES

Limited information on the physical and chemical properties for glycerol monooleate is available. Key physical and chemical properties for monopropylene glycol monooleate are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of monopropylene glycol monooleate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Clear and yellow coloured liquid	2	ECHA
Melting Point	19.2°C @ 101.3 kPa	4	ECHA
Boiling Point	176°C @ 101.3 kPa	4	ECHA
Density	919 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	0 Pa @ 25°C	2	ECHA
Partition Coefficient (log K_{ow})	7.46 @ temperature not indicated (QSAR)	2	ECHA
Water Solubility	0.00000974 g/L @ 25°C (QSAR)	2	ECHA
Flash Point	167°C @101.3 kPa	4	ECHA
Auto flammability	Not auto-flammable	1	ECHA
Viscosity	Not available	-	ECHA
Henry's Law Constant	Not available	-	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

There are limited data available for glycerol monooleate. Monopropylene glycol monooleate is readily biodegradable. It is expected to strongly adsorb to soil, suspended solids and sediment. It has a high potential for bioaccumulation.

B. Biodegradation

No data are available for glycerol monooleate. Monopropylene glycol monooleate is readily biodegradable. Using OECD's QSAR version 3.4, there was a predicted degradation of 68.16% after 28 days under aerobic conditions, as determined by biological oxygen demand (ECHA) [KI. Score = 2].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

No data are available for glycerol monooleate. Based on a soil organic carbon partition coefficient (K_{oc}) of 11,620 L/kg, monopropylene glycol monooleate is expected to strongly adsorb to soil (ECHA). If released to water, based on this K_{oc} value and limited water solubility it is also expected to strongly adsorb to suspended solids and sediment.

D. Bioaccumulation

No data are available for glycerol monooleate. Based on a log K_{ow} of 7.46, monopropylene glycol monooleate has potential for bioaccumulation (ECHA). This is supported by estimated BCF values of 2,000 and 2,006 L/kg (ECHA). However, this value is very likely an overestimate of the substance's bioaccumulation potential since the influence of metabolism (via the common mechanism of β-oxidation), which will be very high for substances in this category, is not fully represented. Overall, substances in the category have a low potential for bioaccumulation (OECD, 2014).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Following oral administration, glyceryl monooleate is digested by lipases into free oleic acid and glycerol. Glyceryl monooleate and monopropylene glycol monooleate have a low potential for acute oral and dermal toxicity. Neither substance is an eye or skin irritant. Likewise, neither is a skin sensitiser. Repeat dose exposure via the oral route resulted in only mild to moderate health effects. Glyceryl monooleate and monopropylene glycol monooleate were non-genotoxic in *in vitro* models. Glyceryl monooleate was not a reproductive or developmental toxicant and did not have carcinogenic potential.

B. Metabolism

Following oral administration, glyceryl monooleate is digested by lipases into free oleic acid and glycerol. Both components are metabolized via standard lipid pathways: glycerol enters gluconeogenesis and glycolysis, while oleic acid is oxidized via B-oxidation for energy, used for lipid storage, or utilized in cellular signalling (PubMed).

C. Acute Toxicity

Oral

An oral LD50 was estimated to be 5,921 mg/kg in rats orally exposed to monopropylene glycol monooleate (ECHA). [Kl. Score = 2]

In an acute oral toxicity study, a single 13 mL/Kg dose of a product containing 5% glyceryl oleate was administered orally to 10 Fischer rats. After a 14-day observation period for signs of toxicity, there were no signs of toxicity and no lethality (CIR).

Dermal

In an acute dermal toxicity study, 2000 mg/kg bw glyceryl oleate did not induce toxicity in rats (CIR).

Inhalation

No data available

D. Irritation

Skin

Monopropylene glycol monooleate can be considered not irritating to male albino rabbit skin (ECHA). [Kl. Score = 2]

In a dermal irritation study, a volume of 0.5 ml of undiluted or 50% concentrations of glyceryl oleate was placed on the clipped dorsal skin of rabbits. Sites were graded for erythema and oedema 2 and 24 hr after exposure. It was concluded that undiluted glyceryl oleate had minimal skin irritation potential; erythema scores ranged from 0.5 to 1.0. There were no reactions at 50% (CIR).

In a dermal toxicity study, a formulation containing 5% glyceryl oleate (0.5 ml) was administered to the clipped skins on New Zealand rabbits. The material was administered daily for 4 days. After a 7-day assessment period for dermal irritation, slight oedema and subsequent slight desquamation, the resultant irritation index was 3.0 (max = 8.0) (CIR).

Eye

Glyceryl oleate was evaluated for ocular irritation in six rabbits using the Draize Eye Test. Undiluted and 50% preparations were administered at a volume of 0.1 ml. In the undiluted applications, the mean Draize scores ranged from 0 to 1 out of 110. Glyceryl oleate produced minimal eye irritation. The 50% glyceryl oleate preparation was also minimally irritating. Slight conjunctivitis was observed after 1 h, clearing within 24 h, and no signs of irritation to other tissues were noted. Hence, Glyceryl oleate was considered to be practically not irritating to rabbit eyes (ECHA). [Kl. Score = 2]

E. Sensitisation

Using QSAR, monopropylene glycol monooleate was predicted to be non-sensitising to the skin of guinea pigs (ECHA).

A repeated insult patch test (RIPT) using 200 people was used to evaluate a 15% aqueous solution of Glyceryl Oleate as a primary irritant, fatiguing agent, and/or sensitizer. Sixteen 24-h occlusive patches were applied to the upper arm three days per week. Nontreatment periods were stated to be the days between alternate day applications and on weekends. No signs of skin irritation were observed after exposure to Glyceryl Oleate in any of the applications (CIR).

F. Repeated Dose Toxicity

Oral

In a repeat dose oral toxicity study, rats were fed glycerol at concentrations up to 20% in their diets or by stomach tube. The animals were fed these diets for a period of 4 to 11 weeks. There were no adverse effects that could be attributed to glycerol consumption (74-7g). Criteria such as body weight gain, food and water intake, resistance to cold, mortality, behaviour, blood chemistry, hematology, and gross and microscopic features of major internal organs and tissues, were observed (CIR).

Oral doses of up to 3 g of undiluted glycerol given three times per day for a total of eight doses resulted in hyperemia, petechial haemorrhages, and erosion of the gastrointestinal mucosa of rats and dogs (CIR).

The feeding of glycerol to rats at concentrations up to 41 O/O (as a dietary supplement) for 21-25 weeks did not produce changes in growth or in the liver, kidneys, or intestines of these animals (CIR).

In another study, subnormal growth was found in rats fed diets containing greater than 30% glycerol for 20 weeks. Pathological changes were observed in rats fed diets containing glycerol at concentrations greater than 10%. The most marked changes were hydropic and fatty changes of hepatocytes (CIR).

Inhalation

No data available

Dermal

In a 28-day subchronic dermal toxicity study, a 25% glyceryl oleate preparation was applied to the shaved intact /abraded skin of rabbits. The rabbits were treated 5 days per week for a period of 4 severe irritation of the skin at the site of application. Alterations included erythema, severe oedema, and desquaacanthosis, hyperkeratosis, focal epidermal ulceration, focal dermal inflammation, abscess formation, and/or focal escharosis at some of the treated sites. No skin reactions were noted in controls. Other results were negative or not treatment related (CIR).

G. Genotoxicity

In Vitro Studies

Based on the prediction done using the OECD QSAR toolbox version 3.4 with log K_{ow} as the primary descriptor and considering the five closest read-across substances, gene mutation was predicted for monopropylene glycol monooleate. The study assumed the use of *Solmonello typhimurium* strains TA 1535, TA 1537, TA 98, TA 100 and TA 102 with S9 metabolic activation system. Monopropylene glycol monooleate was predicted to not induce gene mutation in *Salmonella typhimurium* strains TA 1535, TA 1537, TA 98, TA 100 and TA 102 in the presence of S9 metabolic activation system and hence, according to the prediction made, is not likely to classify as a gene mutant *in vitro* (ECHA).

The *in vitro* genotoxicity studies on glyceryl oleate are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on glyceryl oleate

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Gene mutation study in bacteria (OECD 471)	-	-	-	CIR

*+, positive; -, negative

In Vivo Studies

No data available

H. Carcinogenicity

Oral

Glyceryl oleate administration was associated with development of a few brain tumours (3 tumours in 63 mice) in a two-generation study in mice of the T.M. strain whose feed was supplemented with 50-100 mg/mouse per day glyceryl oleate. Digestive tract tumours were found in T.M. strain mice fed 200 mg/mouse per day glyceryl oleate (feed supplement) for four seven generations and were

considered due to free fatty acid impurities. Therefore, it was concluded that glyceryl oleate is not carcinogenic (CIR).

Inhalation

No data available

Dermal

No data available

I. Reproductive/Developmental Toxicity

A reproduction/developmental toxicity screening test was conducted in male and female Sprague-Dawley rats for glyceryl oleate. Both males and females were dosed by gavage with 0, 100, 300, or 1000 mg/kg bw/day glyceryl oleate in corn oil once daily for 14 days prior to mating; the males were dosed for an additional 28 days, and dosing of the females continued until day 4 of lactation. There were 12 females in the control and 3 test groups, 7 males in the control and high dose groups, and 12 males in the low- and mid-dose groups. A satellite group of 5 males and 5 females were dosed for 42 days, with a 14-day post-dosing observation period. The NOAELs for systemic toxicity (males and females), fertility (males and females), and development (F1 generation) were 1000 mg/kg bw/day. No effects related to the administration of the test-article were observed in parental animals or offspring (CIR).

In the 28-day oral toxicity study with 0, 100, 300 and 1000 mg/kg/day glycerides, C8-18 and C18-unsatd. mono- and di-, acetates in polyethylene glycol, an additional 10 female Wistar Han rats were included in each group to assess reproduction and developmental toxicity. After a minimum of 14 days of dosing, females of the reproduction study group were cohabitated with a male from the same treatment group. The test females were dosed for a total of 41-49 days, i.e. during those 2 weeks prior to mating, during mating, during post-coitum, and during at least 4 days of lactation. No treatment-related effects were observed, and the NOAEL for parental fertility was 1000 mg/kg bw/day.

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for glyceryl monooleate and monopropylene glycol monooleate follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

The lowest NOAEL from these studies is 1000 mg/kg bw/day based on reproduction/developmental toxicity studies conducted in rats on read-across substances. The NOAEL of 1000 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 1000 /(10 x 10 x 1 x 1 x 10) = 1000 /1000 =1.0 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (1.0 x 70 x 0.1)/2 = 14.0 mg/L

B. Cancer

Glyceryl monooleate and monopropylene glycol monooleate do not have carcinogenic potential. Thus, a cancer reference value was not derived

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Glyceryl monooleate and monopropylene glycol monooleate do not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Predicted results for both substances indicate acute toxicity is of moderate concern to aquatic organisms. However, acute aquatic toxicity is unlikely to occur as monopropylene glycol monooleate, and by read-across glyceryl monooleate, is highly insoluble.

B. Aquatic Toxicity

Acute Studies

In accordance with column 2 of Annex VIII of the REACH regulation, testing for this end point is considered scientifically unjustified since there are mitigating factors indicating that aquatic toxicity

is unlikely to occur as the substance is highly insoluble (solubility: 0.000009738 g/L at 25° C) in water (ECHA).

In the OECD SIDS assessment, acute toxicity values were > 100 mg/L or exceeded water solubility for fish, invertebrates and algae for glyceride group members (OECD, 2014).

Chronic Studies

No studies available.

C. Terrestrial Toxicity

No data is available. Low toxicity is expected due to the rapid biodegradability of glyceride group members.

D. Calculation of PNEC

Aquatic and terrestrial toxicity is unlikely to occur. PNECs were not derived.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Glyceride group members are readily biodegradable and thus glyceryl monooleate and monopropylene glycol monooleate do not meet the screening criteria for persistence.

Estimated BCF values were 2,000 and 2,006 L/kg for monopropylene glycol monooleate. Thus, glyceryl monooleate and monopropylene glycol monooleate do meet the criteria for bioaccumulation.

No aquatic toxicity data is available for glyceryl monooleate and monopropylene glycol monooleate due to its high insolubility in water. Aquatic toxicity is unlikely to occur. Thus, glyceryl monooleate and monopropylene glycol monooleate do not meet the criteria for toxicity.

The overall conclusion is that glyceryl monooleate and monopropylene glycol monooleate are not PBT substances.

IX. CLASSIFICATION AND LABELLING

A. Classification

glycerol monooleate

Eye Irrit. 2

monopropylene glycol monooleate

Aquatic Chronic 2

B. Labelling

Warning

C. Pictogram

Glycerol Monooleate



Monopropylene glycol monooleate



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

No workplace exposure standards for glyceryl monooleate and monopropylene glycol monooleate have been established in Australia.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Glycerol monooleate and monopropylene glycol monooleate is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Not listed.

XIII. REFERENCES

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ACRYLAMIDE, 2-ACRYLAMIDO-2-METHYLPROPANESULFONIC ACID, SODIUM SALT POLYMER (CAS RN 38193-60-1)
POLYMER OF 2-ACRYLAMIDO-2-METHYLPROPANESULFONIC ACID SODIUM SALT AND METHYL ACRYLATE (CAS RN 136793-29-8)
ACRYLIC ACID POLYMER WITH SODIUM AMPS, SODIUM SALT (CAS RN 37350-42-8)

This group contains an acrylamide, 2-acrylamido-2-methylpropanesulfonic acid, sodium salt polymer (CAS RN 38193-60-1), polymer of 2-acrylamido-2-methylpropanesulfonic acid sodium salt and methyl acrylate (CAS RN 136793-29-8) and acrylic acid polymer with sodium AMPS, sodium salt (CAS RN 37350-42-8). They are expected to have similar environmental concerns and have consequently been assessed as a group. Information provided in this dossier is based on data for the monomer sodium acryloyldimethyltaurate (CAS RN 5165-97-9).

This dossier presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam and shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed acrylamide, 2-acrylamido-2-methylpropanesulfonic acid, sodium salt polymer (CAS RN 38193-60-1), polymer of 2-acrylamido-2-methylpropanesulfonic acid sodium salt and methyl acrylate (CAS RN 136793-29-8) and acrylic acid polymer with sodium AMPS, sodium salt (CAS RN 37350-42-8) in an IMAP Tier 1 assessment and considers them each a polymer of low concern, and concluded that it poses no unreasonable risk to human health and the environment[1].

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): acrylamide, 2-acrylamido-2-methylpropanesulfonic acid, sodium salt polymer

CAS RN: 38193-60-1

Molecular formula: (C7-H13-N-O4-S.C3-H5-N-O.Na)x-

Molecular weight: 302.32 g/mol (monomer); Based on the type and intended use, the molecular weight of the polymer would likely range from 1,000 to > 1,000,000 g/mol (CIR, 2017).

Synonyms: 1-Propanesulfonic acid, 2-methyl-2-((1-oxo-2-propen-1-yl)amino)-, sodium salt (1:1), polymer with 2-propenamide

SMILES: Not applicable

[1] https://www.industrialchemicals.gov.au/help-and-guides/polymer-low-concern-plc-criteria

Chemical Name (IUPAC): Polymer of 2-acrylamido-2-methylpropanesulfonic acid sodium salt and methyl acrylate

CAS RN: 136793-29-8

Molecular formula: (C7-H13-N-O4-S.C4-H6-O2.Na)x-

Molecular weight: 315.3202 g/mol (monomer); Based on the type and intended use, the molecular weight of the polymer would likely range from 1,000 to > 1,000,000 g/mol (CIR, 2017).

Synonyms: 2-Propenoic acid, 2-methyl-, polymer with 2-methyl-2-((1-oxo-2-propenyl)amino)-1-propanesulfonic acid monosodium salt

SMILES: Not applicable

Chemical Name (IUPAC): sodium;2-methyl-2-(prop-2-enoylamino)propane-1-sulfonate

CAS RN: 5165-97-9

Molecular formula: $C_7H_{12}NNaO_4S$

Molecular weight: 229.23 g/mol

Synonyms: 1-Propanesulfonic acid, 2-methyl-2-[(1-oxo-2-propenyl)amino]-, monosodium salt

SMILES: CC(C)(CS(=O)(=O)[O-])NC(=O)C=C.[Na+]

Chemical Name (IUPAC): Sodium 2-acrylamido-2-methylpropanesulfonate-sodium acrylate copolymer

CAS RN: 37350-42-8

Molecular formula: $(C_7H_{13}NO_4S.C_3H_4O_2.2Na)_x$

Molecular weight: 325.29 g/mol (monomer)

Synonyms: acrylic acid polymer with sodium AMPS, sodium salt; 2-Propenoic acid, sodium salt (1:1), polymer with sodium 2-methyl-2-[(1-oxo-2-propen-1-yl)amino]-1-propanesulfonate (1:1)

SMILES: [Na].[Na].O=C(O)C=C.O=C(C=C)NC(C)(C)CS(=O)(=O)O

II. PHYSICAL AND CHEMICAL PROPERTIES

Physical and chemical properties were not available for acrylamide, 2-acrylamido-2-methylpropanesulfonic acid, sodium salt polymer (CAS RN 38193-60-1), polymer of 2-acrylamido-2-methylpropanesulfonic acid sodium salt and methyl acrylate (CAS RN 136793-29-8) and acrylic acid polymer with sodium AMPS, sodium salt (CAS RN 37350-42-8). Available information for the monomer is provided in Table 1.

Table 1: Overview of the Physico-chemical Properties of Sodium Acryloyldimethyltaurate (CAS RN 5165-97-9)

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Light amber liquid @ 25°C with a faint organic odour	1	ECHA
Melting Point	-25°C @ 101.3 kPa	1	ECHA
Boiling Point	110°C @ 101.3 kPa	2	ECHA
Density	1200 - 1300 kg/m^3 @ 20°C	2	ECHA
Vapour Pressure	7.4 x 10^{-9} Pa @ 25°C	1	ECHA
Partition Coefficient (log K_{ow})	-4.34 (temperature and pH not specified)	2	ECHA
Water Solubility	1000 g/L @ 25°C	2	ECHA
Flash Point	No data available	-	-
Auto flammability	No data available	-	-
Viscosity	0.6 mm^2/s @ 20°C	2	ECHA
Dissociation constant	No data available	-	-

III. ENVIRONMENTAL FATE PROPERTIES

No data is available for the polymers and limited studies are available for the monomer (sodium acryloyldimethyltaurate). The polymers are not expected to be readily biodegradable. The physico-chemical properties of the polymers would preclude it from undergoing significant biodegradation (Guiney et al., 1997). Biodegradation is limited due to the very high molecular weight and the low water solubility of the polymers. In addition, sodium acryloyldimethyltaurate was evaluated in a 44-day biodegradation in water study . This substance showed low biodegradation with a rate of less than 10% after 44 days (ECHA). [Kl. Score = 1]

Acryloyldimethyltaurate polymers are large (2000 µm; >1000 to >1,000,000 g/mol) molecules (CIR, 2017). Anionic polymers of this type will likely bind tightly to organic matter found within soils and sediments (Guiney et al., 1997). However, the polymers are not expected to bioaccumulate because of their poor water solubility and high molecular weight.

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Sodium acryloyldimethyltaurate has low acute toxicity by the oral and dermal routes. It is not a skin or eye irritant; and, it is not a skin sensitiser. No systemic toxic effects were observed in repeated dose subchronic oral toxicity studies. Sodium acryloyldimethyltaurate is not genotoxic and is not a developmental toxicant.

B. Acute Toxicity

~~Oral~~

An OECD Guideline 401 (Acute Oral Toxicity) was performed. The study was conducted to determine the acute oral toxicity of sodium acryloyldimethyltaurate in Sprague-Dawley rats. Groups of 10 fasted animals (5 males and 5 females per dose except for 5 males only at the highest dose) were administered 0, 500, 1000, 2000, 4000, and 8000 mg/kg of the test substance via the oral route. The animals were observed for 14 days after dosing and then sacrificed and subjected to gross pathological examination. No unusual clinical or behavioural signs were observed in animals receiving dosages ranging from 1000-8000 mg/kg. Animals receiving 16000 mg/kg appeared ruffled and lethargic within 3-4 hours of test material administration. All animals appeared normal by day 5. No unscheduled deaths were recorded and gross examination revealed no pathological findings. There were no effects in the rat at the highest dose of 16,000 mg/kg. This is considered to be the No Observed Adverse Effect Level (NOAEL) (ECHA) [Kl. score =1].

The results from an OECD Guideline study (425) in rats showed that the LD_{50} > 5,000 mg/kg (> 1,200 mg/kg bw/day) for sodium acryloyldimethyltaurate (CIR, 2017).

Inhalation

No data was available.

Dermal

An OECD Guideline 402 (Acute Dermal Toxicity) was performed using New Zealand White rabbits. Under the conditions of the test, The LD_{50} of the test substance (OS 114454) was found to be greater than 2000 mg/kg (based on active ingredient, 4000 mg/kg based on test substance) when administered once for 24 hours to the clipped, intact skin of male and female albino rabbits. In addition, 2000 mg/kg was found to be a No-Observable-Effect Level (NOEL) for systemic toxicity under the conditions of this study. (ECHA) [Kl Score=1].

The results from an OECD Guideline (402) study in rats showed that the dermal LD_{50} for sodium acryloyldimethyltaurate is > 5,000 mg/kg (1,200 mg/kg bw/day) (CIR, 2017).

C. Irritation

Skin

Sodium acryloyldimethyltaurate was determined to be a minimal dermal irritant to rabbits by the USEPA (OPPTS 870.2500, Acute Dermal Irritation) and a dermal non-irritant based on OECD Guideline 404 (ECHA). [KI Score = 1].

Eye

Sodium acryloyldimethyltaurate was determined to be slightly irritating to the eye based on an OECD 405 study (CIR, 2017). In a USEPA OPPTS 870.2400 (Acute Eye Irritation) test, sodium acryloyldimethyltaurate was determined to be not irritating to the eye (ECHA). [KI Score = 1].

D. Sensitisation

There was no evidence that sodium acryloyldimethyltaurate was sensitising to human (HRIPT test) or rats (OECD Guideline 406 study) (CIR, 2017).

An EU Method B.6 (Skin Sensitisation) study (i.e., guinea pig maximisation test) was performed on Dunkin-Hartley guinea pigs. Under the conditions of this study, the test substance (OS 114454) did not produce evidence of skin sensitisation (delayed contact hypersensitivity) in nine of the ten test animals. The remaining animal gave an inconclusive response. The test substance was considered to be non-sensitising (ECHA). [Kl. Score = 1].

E. Repeated Dose Toxicity

Oral

In an OECD Guideline (407) study, sodium acryloyldimethyltaurate was exposed to Sprague Dawley rats via oral gavage for 28 days at doses of 50, 150, 400 and 1000 mg/kg bw/day. No significant toxicity was observed at any dose level. The NOEL was determined to be 1,000 mg/kg bw/day (ECHA). [KI Score = 1].

Inhalation

No studies are available.

Dermal

No studies are available.

F. Genotoxicity

In Vitro Studies

The results of the *in vitro* genotoxicity studies on sodium acryloyldimethyltaurate are presented in Table 2. In general, the substance did not produce a significant increase in the number of revertants, with and without metabolic activation in any test strain (ECHA). [Kl. Score = 1]..

Table 2: *In Vitro* Genotoxicity Studies on sodium acryloyldimethyltaurate

Test System1	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay) (Bacterial Reverse Mutation Assay)	-	-	1	CIR, 2017
Ames test, S. typhimurium (TA98, TA100, TA1535 and TA 1537) and E. coli (WP2uvrA)	-	-	-	CIR, 2017
OECD Guideline 473 (In Vitro mammalian chromosome aberration test) Chinese hamster ovary cells	-	+	1	ECHA

Test System1	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 476 (Chinese hamster ovary cells)	-	-	1	ECHA

*+, positive; -, negative.

In Vivo Studies

An OECD Guideline 475 (Mammalian Bone Marrow Chromosome Abberation Test) study was conducted using Sprague Dawley rats exposed via oral gavage to sodium acryloyldimethyltaurate. The test material was non-clastogenic in rat bone marrow cells under the conditions of the assay (ECHA). [Kl. Score = 1]...

G. Carcinogenicity

Oral

No studies are available.

Inhalation

No studies are available.

Dermal

No studies are available.

H. Reproductive Toxicity

Oral

An OECD Guideline 421 (Reproduction / Developmental Toxicity Screening Test) was performed using male and female Sprague-Dawley rats. Dosing preparations were administered orally, by gavage, as a single dose daily to F0 males and females beginning two weeks prior to mating. The F0 males were dosed for approximately seven weeks, including two weeks prior to mating, during mating and post-mating. The F0 females were dosed throughout the study, including two weeks prior to mating, during mating, during gestation, and following parturition. Individual doses were adjusted based on the most recent body weight data. Both F0 males and females were dosed up to and including the day prior to scheduled euthanasia.

Oral administration of OS#132086 at dosage levels of 100, 500 and 1000 mg/kg/day had no effect on F0 survival, growth, mating behavior, copulation, fertility, precoital intervals, gestation lengths, corpora lutea counts, implantation counts, mean live litter size, prelpost-implantation loss, gross necropsy findings or organ weights (testes and epididymides). Histopathological examination of the testes, ovaries and epididymides from control and high-dose rats did not reveal any test article-related microscopic changes. No test article-related effects were observed in the F1 offspring with respect to survival, clinical observations, body weights or gross necropsy findings. In addition, there were no indications of test article-related developmental effects in the F1 pups at any dosage level tested. Based

on the results, a dosage level of 1000 mg/kg bw/day was considered a NOEL for this reproduction and developmental screening study in rats (ECHA). [Kl. Score = 1].

I. Developmental Toxicity

No studies are available.

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for sodium acryloyldimethyltaurate follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2021).

A. Non-Cancer

Oral

The developmental toxicity NOAEL of 1,000 mg/kg bw/day was determined for a test substance that contained sodium acryloyldimethyltaurate. This value is equivalent to the NOAEL determined from a repeated dose oral toxicity study for sodium acryloyldimethyltaurate (also 1,000 mg/kg bw/day). This NOAEL will be used for determining the oral reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 1000/(10 x 10 x 1 x 1 x 10 x 1) = 1000/1000 = 1 mg/kg/day.

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2021)
Proportion of water consumed = 10% (ADWG, 2021)
Volume of water consumed = 2L (ADWG, 2021)
Drinking water guidance value = (1 x 70 x 0.1)/2 = 3.5 mg/L

B. Cancer

Sodium acryloyldimethyltaurate is not considered a carcinogen. Thus, a cancer reference value will not be calculated for this substance.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Sodium acryloyldimethyltaurate does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Sodium acryloyldimethyltaurate exhibits low toxicity to aquatic organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on sodium acryloyldimethyltaurate.

Table 3: Acute Aquatic Toxicity Studies on Sodium Acryloyldimethyltaurate

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Lepomis macrochirus (Bluegill)	96-hour LC_{50}	1000	1	ECHA
Daphnia magna	48-hour EC_0	1000	1	ECHA

Chronic Studies

Sodium acryloyldimethyltaurate has been evaluated for its toxicity towards the fresh water alga *Pseudokirchneriella subcapitata* (formerly *Selenastrum capricarnutum*) in an Alga growth inhibition test according to OECD 201 under GLP requirements. The exposure duration was 96 hours under static conditions. The NOEC growth rate determined from the study was 2000 mg/L (ECHA) [Kl. Score = 1].

C. Terrestrial Toxicity

No studies are available.

D. Calculation of PNEC

The PNEC calculations for sodium acryloyldimethyltaurate follow the methodology discussed in DEWHA (2009).

PNEC water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (1,000 mg/L) and *Daphnia* (1,000 mg/L). Results from chronic studies are also available for one trophic level (algae), with a NOEC of 2,000 mg/L. On the basis that the data consists of short-term studies for two trophic levels and long-term studies from one trophic level, an assessment factor of 100 has been applied to the lowest reported EC_{50} value of 1,000 mg/L for Lepomis macrochirus. Therefore, the $PNEC_{water}$ is 10 mg/L.

This value is more conservative than a PNEC derived using chronic data from the algae study (i.e., 20 mg/L).

PNEC sediment

There are no toxicity data for sediment-dwelling organisms. The K_{ow} and K_{oc} have not been experimentally derived for sodium acryloyldimethyltaurate; these values cannot be reliably estimated using QSAR models. For example, estimated K_{oc} values using USEPA's EPISUITE vary between 10 L/K (MCI method) and 0.03155 L/kg (K_{ow} method). Thus, the equilibrium partitioning method cannot be used to calculate the $PNEC_{sed}$.

PNEC soil

There are no toxicity data for soil-dwelling organisms. The K_{ow} and K_{oc} have not been experimentally derived for sodium acryloyldimethyltaurate; these values cannot be reliably estimated using QSAR models. For example, estimated K_{oc} values using USEPA's EPISUITE vary between 10 L/K (MCI method) and 0.03155 L/kg (K_{ow} method). Thus, the equilibrium partitioning method cannot be used to calculate the $PNEC_{soil}$.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Based on the information for read-across substance sodium acryloyldimethyltaurate, the polymers in this groups are not readily biodegradable. Thus, they meet the screening criteria for persistence.

The polymers in this group are not expected to bioaccumulate because of their poor water solubility and high molecular weight. Therefore, these polymers do not meet the screening criterion for bioaccumulation.

The chronic toxicity data on read-across substance sodium acryloyldimethyltaurate show NOECs of > 0.1 mg/L. Acute E(L)C_{50} values are also greater than 1 mg/L. Thus, the polymers in this group do not meet the screening criteria for toxicity.

The overall conclusion is that acrylamide, 2-acrylamido-2-methylpropanesulfonic acid, sodium salt polymer and polymer of 2-acrylamido-2-methylpropanesulfonic acid sodium salt and methyl acrylate are not PBT substances.

IX. CLASSIFICATION AND LABELLING

A. Classification

Irritation-Skin: H315 Causes skin irritation.

Aquatic Tox. H413: May cause long lasting harmful effects to aquatic life.

B. Signal word

Warning

C. Pictogram



X. SAFETY AND HANDLING

A. First Aid

Please refer to the product SDS for additional information and for confirmation of the information provided herein.

Eye Contact

Immediately flush open eyes with plenty of water for at least 15 minutes. Remove contacts, if present and easy to do. Get medical attention immediately, preferably a physician for an ophthalmologic examination.

Skin Contact

For minor skin contact, avoid spreading material on unaffected skin. Remove and isolate contaminated clothing. Wash the contaminated area of body with soap and fresh water. Get medical attention. Launder contaminated clothing before reuse.

Inhalation

Move person to fresh air. Administer oxygen if breathing is difficult. Do not use mouth-to-mouth method if victim inhaled the substance; give artificial respiration with the air of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Give artificial respiration if victim is not breathing. Get medical attention immediately.

Ingestion

Do not induce vomiting. Get medical attention immediately.

Notes to Physician

All treatments should be based on observed signs and symptoms of distress in the patient.

B. Fire Fighting Information

Extinguishing Media

Use water spray or fog, foam, dry chemical or carbon dioxide.

Specific Exposure Hazards

Emits toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon dioxide, carbon monoxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus and chemical-protective clothing.

C. Accidental Release Measures

Personal Precautions

Isolate area. Keep unnecessary and unprotected personnel from entering the area. Use personal protective clothing. Ensure adequate ventilation. Wear respiratory protection if ventilation is inadequate. Do not breath mist, vapours or spray. Avoid contact with skin, eyes and clothing. Eliminate all sources of ignition.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

Eliminate all sources of ignition. Pick up with suitable absorbent material and transfer to a container for chemical waste. For large amounts: dike spillage and pump off product into container for chemical waste. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep away from heat, sparks and flame. Avoid contact with eyes, skin and clothing. Avoid breathing vapour. Wash thoroughly after handling. Keep container closed. Use with adequate ventilation.

Storage

Keep container tightly closed. Store away from heat and light.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

Workplace Australia has not established an occupational exposure standard for acrylamide, 2-acrylamido-2-methylpropanesulfonic acid, sodium salt polymer or polymer of 2-acrylamido-2-methylpropanesulfonic acid sodium salt and methyl acrylate.

Engineering Controls

Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Personal Protection Equipment

Respiratory Protection: If workers are exposed to concentrations above the exposure limit, they must use appropriate, certified respirators. If there are no applicable exposure limit requirements or guidelines, use an approved respirator. Selection of air-purifying or positive pressure supplied-air will depend on the specific operation and the potential airborne concentration of the product. For emergency conditions, use an approved positive-pressure self-contained breathing apparatus. The following should be an effective type of air-purifying respirator: organic vapour cartridge with a particulate pre-filter.

Hand Protection: Use gloves chemically resistant to this material. Consult the SDS for appropriate glove barrier materials.

Skin Protection: Use protective clothing chemically resistant to the material. Selection of specific items such as face shield, boots, apron or full body suit will depend on the task.

Eye Protection: Use chemical goggles.

Other Precautions: Wash hands, forearms and face thoroughly after handling chemical products; before eating, smoking and using the lavatory; and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

UN number: none

XI. DISPOSAL MANAGEMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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ALCOHOLS, C6-12, ETHOXYLATED PROPOXYLATED
ALCOHOLS, C10-16, ETHOXYLATED PROPOXYLATED
ALCOHOLS, C16-18, ETHOXYLATED PROPOXYLATED

This dossier on alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated presents the most critical studies pertinent to the risk assessment of these alcohols in their use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated were not identified in chemical databases used by NICNAS as an indicator that the chemicals are of concern and are not PBT substances. Alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated alcohols, and alcohols, C_{16-18}, ethoxylated propoxylated were assessed as a tier 2 chemical for acute toxicity and as a tier 1 chemical for chronic toxicity. Therefore, these substances are classified overall as **tier 2** chemicals and requires a hazard assessment and qualitative assessment of risk.

1 BACKGROUND

Alcohol alkoxylates (AAs) are a class of non-ionic surfactants that have the basic structure $C_{x-y}AO_n$. where the hydrophilic alkoxylate (AO) chain is attached via an ether linkage to the hydrophobic aliphatic alcohol chain ($C \geq 6$) The subscript (x-y) following the 'C' indicates the range of carbon chain units. The alkyl chain can be either linear, branched, saturated or unsaturated in the AA group. Generally, increasing the carbon chain length increases lipophilicity, whereas increasing alkoxylation increases hydrophilicity of the chemical. The only difference between AAs and similar alcohol ethoxylates (AEs) is the inclusion of polypropylene glycol (PPG) units for fine-tuning the surfactant properties of the AA chemicals (NICNAS, 2020).

Alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated are expected to be readily biodegradable. They have a low to moderate potential for bioaccumulation and a low to moderate potential for absorption to soil and sediment.

Based on read-across with similar AAs, acute toxicity of alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated is expected to be low by the oral and inhalation routes and low to moderate by the dermal route. AAs are expected to be irritating to skin and eyes of rabbits but are not skin sensitisers. Repeated dose toxicity studies on read-across analogue AEs similar to alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated in rats do not indicate any target organ effects. AAs are not expected to be reproductive or developmental toxicants. No information was available to assess genotoxicity or carcinogenicity.

Alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated have low toxicity to aquatic and terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Alcohols, C_{6-12}, ethoxylated propoxylated

CAS RN: 68937-66-6

Molecular formula: Not available (UVCB substance)

Molecular weight: Not available (UVCB substance)

Synonyms: Not available (UVCB substance)

Chemical Name (IUPAC): Alcohols, C_{10-16}, ethoxylated propoxylated

CAS RN: 69227-22-1

Molecular formula: Not available (UVCB substance)

Molecular weight: Not available (UVCB substance)

Synonyms: Ethoxylated propoxylated C10-16 alcohols

Chemical Name (IUPAC): Alcohols, C_{16-18}, ethoxylated propoxylated

CAS RN: 68002-96-0

Molecular formula: Not available (UVCB substance)

Molecular weight: Not available (UVCB substance)

Synonyms: Ethoxylated propoxylated C16-18 alcohols

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for alcohols, C_{6-12}, ethoxylated propoxylated and alcohols, C_{10-16}, ethoxylated propoxylated and are shown in Table 1. Information was not available for alcohols, C_{16-18}, ethoxylated propoxylated.

Table 1 Overview of the Physico-chemical Properties of alcohols, C_{6-12}, ethoxylated propoxylated and alcohols, C_{10-16}, ethoxylated propoxylated

Property	C_6-C_{12}	C_{10}-C_{16}	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Yellow liquid, mild odour	Yellow liquid, mild odour	-	Univar, 2025
Melting Point	133°C @ 101.3 kPa	-3.92°C @ 101.3 kPa	2	EPA, 2019
Boiling Point	397°C @ 101.3 kPa	226°C @ 101.3 kPa	2	EPA, 2019
Density	Not available	Not available	-	-
Vapor Pressure	2.48×10^{-6}Pa @ 20°C	19.9 Pa @ 20°C	2	EPA, 2019
Partition Coefficient (log K_{ow})	1.29 @ 25°C	4.98 @ 25°C	2	EPA, 2019
Water Solubility	1.587 g/L @ 25°C	0.00287 g/L @ 25°C	2	EPA, 2019
Dissociation constant (pKa)	Not available	Not available	-	-
Viscosity	Not available	Not available	-	-

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). These alcohols are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated.

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated are expected to be readily biodegradable. They have a low to moderate potential for bioaccumulation and a low to moderate potential for absorption to soil and sediment.

B. Biodegradation

Alcohols, C_{6-12}, ethoxylated propoxylated and alcohols, C_{10-16}, ethoxylated propoxylated are readily biodegradable. In an OECD 301 F test, degradation of alcohols, C_{6-12}, ethoxylated propoxylated and alcohols, C_{10-16}, ethoxylated propoxylated was >60% in 28 days (MilliporeSigma, 2026).

Read-across analogue AE alcohols, C_{12-15}, ethoxylated is readily biodegradable. In an OECD 301B test, degradation was 72% in 28 days but failed the 10-day window (ECHA) [KI.score=1].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

No experimental data are available for alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated. Using KOCWIN in EPISUITE™ (EPA, 2019), the estimated K_{oc} value for alcohols, C_{6-12}, ethoxylated propoxylated is 10.1 L/kg (MCI) and 5.946 L/kg (K_{ow}). The estimated K_{oc} value for alcohols, C_{10-16}, ethoxylated propoxylated is 1,180 L/kg (MCI) and 3,882 L/kg (K_{ow}). The estimated K_{oc} value for alcohols, C_{16-18}, ethoxylated propoxylated is 43,200 L/kg (MCI) and 164,200 L/kg (K_{ow}).

D. Bioaccumulation

No experimental data are available for alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated. Using BCFBAF in EPISUITE™ (EPA, 2019), the estimated BCF value for alcohols, C_{6-12}, ethoxylated propoxylated is 3.3 L/kg (based on a log K_{ow} of 1.29), for alcohols, C_{10-16}, ethoxylated propoxylated is 37.8 L/kg (based on a log K_{ow} of 4.98) and for alcohols, C_{16-18}, ethoxylated propoxylated is 1,187 L/kg (based on a log K_{ow} of 7.92).

6 HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Based on read-across with similar AAs, acute toxicity of alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated is expected to be low by the oral and inhalation routes and low to moderate by the dermal route. AAs are expected to be irritating to skin and eyes of rabbits but are not skin sensitisers. Repeated dose toxicity studies on read-across analogue AEs similar to alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated in rats do

not indicate any target organ effects. AAs are not expected to be reproductive or developmental toxicants. No information was available to assess genotoxicity or carcinogenicity.

B. Toxicokinetics

No data is available for alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated or other similar AAs. Based on read-across information from AE analogues, alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated are expected to be absorbed, metabolised and excreted in the urine, faeces and in expired air with minimal tissue distribution, following oral exposure. Excretion following dermal absorption is primarily via the urine (NICNAS, 2020).

C. Acute Toxicity

Oral

The oral LD_{50} in rats for $C_{8-10}AO_n$ is >810-1660 mg/kg bw and for $C_{12-18}AO_n$ is 2478 mg/kg bw. At necropsy, haemorrhage of the internal organs were observed, e.g. mottled red lung, dark maroon spleen and liver, distended and/or vascularised intestine and stomach, and blood in the urine (NICNAS, 2020).

Dermal

Based on the available data, AAs are expected to have low to moderate acute dermal toxicity with LD50 values ranging from 790 to <16,000 mg/kg bw. The acute dermal LD_{50} in rabbits for $C_{8-10}AO_n$ is 1680-3250 mg/kg bw and for $C_{12-18}AO_n$ is 1476 mg/kg bw (NICNAS, 2020).

Inhalation

The 1-hour inhalation LC_{50} value for $C_{8-10}AO_n$ is 8,000 mg/m^3 as a saturated vapor. The 4-hour inhalation LC_{50} value for $C_{12-18}AO_n$ is 360-520 mg/m^3 as an aerosol (NICNAS, 2020).

D. Irritation

Skin

Application of $C_{8-10}AO_n$ to the skin of rabbits for 4 hours under occlusive conditions was found to be a skin irritant while application of $C_{12-18}AO_n$ was found to be a severe skin irritant. Application of $C_{12-14}AO_n$ was found to be a non-irritant (NICNAS, 2020).

Eyes

Instillation of $C_{12-14}AO_n$ into the eyes of rabbits was minimally irritating. Instillation of $C_{8-10}AO_n$ and $C_{12-18}AO_n$ into the eyes of rabbits was severely irritating with a score of 33.5/110 and 32.4/110, respectively. Instillation of $C_{12-15}AO_n$ into the eyes of rabbits was severely irritating and irreversible with a mean 7-day score of 35.5/100 for corneal opacity, iritis, and conjunctivitis, and blood vessels on cornea were observed (NICNAS, 2020).

E. Sensitisation

Based on read-across to AE analogues, AAs are not considered to cause skin sensitization. In a guinea pig maximization test, alcohols, C_6-C_8-(even numbered, linear)-ethoxylated (<2.5 EO) was not found to be a skin sensitiser (ECHA) [KI.score=1].

In a guinea pig maximization test, C_{12}-$_{13}$AE<2.5 (CAS RN 66455-14-9) was not found to be a skin sensitiser (ECHA) [KI.score=2].

F. Repeated Dose Toxicity

Oral

No data is available for alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated or other similar AAs. Read-across from AE analogues is provided below.

Male and female CFE (SPF) rats were given in their feed 0, 125, 250, 500, 1,000, or 3,000 ppm (0, 6.25, 12.5, 25, 50, and 150 mg/kg-day) $C_{9-11}AE_6$ for 13 weeks. There was no mortality and no treatment-related clinical signs. Body weights were significantly lower in the ≥250 ppm males throughout the study; body weights of the 125 ppm males were lower for only the first half of the study. Feed consumption was lower in treated males with the change being statistically significant in the ≥1,000 ppm males. This reduction in feed consumption was thought to be related to palatability; the feed conversion efficiency values were similar for treated and control males, and so it is not possible to attribute the reduced body weights to the toxicity of the test material alone. The female rats showed no differences in body weights and feed consumption. There were no treatment-related changes in hematology parameters, and the clinical chemistry parameters and organ weights showed no changes that were considered to be of toxicological significance. Gross pathology showed no treatment-related changes. The NOAEL for this study was considered to be 3,000 ppm, which corresponds to150 mg/kg-day (ECHA) [KI.score=2].

Rats were given in their feed 0, 0.04, 0.2, or 1% $C_{9-11}AE_8$ for 90 days. There were no deaths or treatment-related clinical signs during the study. There was reduced body weight gain and decreased feed consumption in the 1% animals and in the 0.2% females throughout the study. Additional statistical analysis indicated a significant decrease in mean body weight gain in the 1% females and decreased feed consumption in the 1% males and females. The reduced body weight gain of the 0.2% females was not statistically significant. The study authors considered these changes to be due to the poor palatability of the test material in the feed. Organ weights, gross and microscopic pathology were similar across groups. The NOAEL for this study is 1% in the diet, which corresponded to 400 mg/kg-day (HERA, 2009) [KI.score=2].

Rats were given in their feed 0, 125, 250, or 500 mg/kg $C_{10}AE_5$ for 90 days. There were no deaths or treatment-related clinical signs during the study. The only treatment-related effect noted was a slight increase in absolute liver weights with the 500 mg/kg animals showing statistical significance. However, there were no corresponding histopathologic changes in the liver. The NOAEL is 500 mg/kg-day, the highest dose tested (HERA, 2009) [KI.score=2].

Rats were given in their diet 0%, 0.0313%, 0.0625%, 0.125, 0.25, 0.5 or 1.0% $C_{12-15}AE_7$ for 90 days. The animals in the ≥0.25% groups showed significantly reduced body weight gain, which was associated with marked decreases in food and water consumption. Relative liver weights were

significantly increased in the ≥0.5% male rats and ≥0.25% females. Histopathologic examination showed hepatocytic enlargement in the ≥0.125% groups, suggesting increased liver metabolism on the basis of increased alkaline phosphatase activity at the higher dose levels. The NOAEL was established at 0.0625% in the diet or 102 mg/kg-day (HERA, 2009) [Kl.score=2].

Rats were fed $C_{12-14}AE_7$ in the diet at concentrations of 0%, 0.0313%, 0.0625%, 0.125%, 0.25%, 0.5% and 1.0% for 90 days. The animals in the ≥0.25% groups showed significantly reduced body weight gain, which was associated with marked decreases in food and water consumption. Relative liver weights were significantly increased in the ≥0.5% male rats and ≥0.25% females. Histopathologic examination showed hepatocytic enlargement in the ≥0.125% groups, suggesting increased liver metabolism on the basis of increased alkaline phosphatase activity at the higher dose levels. The NOAEL was established at 0.0625% in the diet or 110 mg/kg-day (HERA, 2009) [Kl.score=2].

Rats were given 0, 0.1, 0.5 or 1% $C_{12-13}AE_{6.5}$ in their diet for two years. Body weight gain was reduced in the 1% males and ≥0.5% females, which was likely due to the reduced food consumption in these animals. At study termination, organ to body weight ratios were increased in the ≥0.5% females (liver, kidney and brain), 1% females (heart), and 1% males (liver). A dose-related focal myocarditis was observed in males. While focal myocarditis is commonly observed in non-treated aging rats, the incidence in the treated animals was higher than in the controls. The NOAEL was established at 0.1% or 50 mg/kg-day (HERA, 2009) [Kl.score=2].

Inhalation

There are no studies available for alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated or other similar AAs in the C_6-C_{16} range.

Dermal

No data is available for alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated or other similar AAs. Read-across from AE analogues is provided below.

Male and female F344 rats were given dermal applications of 0, 1, 10, or 25% $C_{9-11}AE_6$ solutions 3 days/week for 13 weeks. There were no deaths during the study and no clinical signs of toxicity. Body weights, clinical chemistry and hematology parameters, and urinalysis showed no differences between treated and control animal. The 25% animals showed a slight increase in kidney weights, although no histopathologic findings were noted in the kidney. There were no histopathologic changes that were considered to be treatment related. The NOAEL for this study is 25% (Gingell and Lu, 1991; ECHA) [Kl.score=2].

G. Genotoxicity

No data are available.

H. Carcinogenicity

No data are available.

I. Reproductive and Developmental Toxicity

No data is available for alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated or other similar AAs. Read-across from AE analogues is provided below.

A two-generation reproductive toxicity study was conducted on $C_{9-11}AE_6$. Male and female F344 rats were given dermal applications of 0, 1, 10 or 25% solutions of $C_{9-11}AE_6$ (0, 10, 100 or 250 mg/kg-day) 3 days/week; the F_0 and F_1 generations were treated for 119 and 133 days, respectively, before mating. There were no deaths in the F_0 generation, but there were 5 deaths in the F_1 generation (controls and treatment groups) that were not considered to be treatment related. Animals in either generation showed no skin reactions. Body weights of the 25% F_0 and F_1 parental animals were lower during certain periods of the study; however, maternal body weights in both generations were similar across groups during the gestational and lactational periods. The organ weights in the F_0 animals were similar between treated and control animals; the F_1 parental animals showed sporadic organ weight changes but were not no toxicological significance. There were no histopathologic changes that correlated with the organ weight changes in the F_1 parental animals. Mating and fertility indices were similar across groups in both generations. There were no treatment-related effects on testicular weights, testicular pathology, serum counts and LDH-X activity toxicity in either generation. Macroscopic and microscopic evaluations of the reproductive organ showed no treatment-related effects. The NOAEL for reproductive toxicity for toxicity is 25% test concentration, which corresponded to 250 mg/kg-day, the highest dose tested (Gingell & Lu, 1991; ECHA) [Kl.score=2].

CD rats were given in their diet 0, 0.05, 0.1 or 0.5% (approximately 0, 25, 50 or 250 mg/kg-day) $C_{12}AE_6$ in a two-generation reproductive toxicity study. There were no treatment-related effects in the parents or pups on general behaviour, appearance or survival. At 0.5%, there was reduced weight gain in both the parental animals and the pups compared with the controls. Fertility was unaffected by treatment. The NOAEL for reproductive toxicity is 0.5% in the diet, which corresponds to 250 mg/kg-day (HERA, 2009) [Kl.score=2].

In a two-generation reproductive toxicity study, Charles River rats were given in their diet 0, 0.05, 0.1 or 0.5% (about 0, 25, 50 or 250 mg/kg-day) $C_{12}AE_6$. General behaviour, appearance and survival were unaffected by treatment. At the 0.5% dose level, adults and pups gained less weight than the control rats. In the 0.5% dose group, there was a statistical increase in embryo lethality and soft tissue anomalies, and at the 0.1% there was a statistical decrease in mean fetal liver weight. Neither of these effects was considered to be treatment-related by the authors as they showed no dose response characteristics. The NOAEL for maternal toxicity is 50 mg/kg-day. The NOAEL for developmental and teratogenicity is 0.1% in the diet or 50 mg/kg-day (HERA, 2009) [Kl.score=2].

Pregnant rabbits were given by oral gavage 0, 50, 100 or 200 mg/kg $C_{12}AE_6$ from gestational days 2 to 16. Nine control rabbits and 31 treated rabbits died during the study. Surviving rabbits at the 200 mg/kg dose group generally showed slight losses of body weight. At 100 and 200 mg/kg, ataxia and a slight decrease in body weight was observed in the pregnant animals. In seven treated and two control rabbits, early deliveries were recorded. There were no treatment-related effects on corpora lutea, implantations, number of live foetuses or spontaneous abortions. The NOAEL for maternal toxicity is 50 mg/kg-day; the NOAEL for developmental toxicity is 200 mg/kg-day (HERA, 2009) [Kl.score=2].

J. Derivation of Toxicological Reference and Drinking Water Guidance Values

The toxicological reference values developed for alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2021).

Non-Cancer

A two-year dietary study in rats has been conducted on read-across AE analogue $C_{12-13}AE_{6.5}$ (HERA, 2009). The NOAEL from this study is 50 mg/kg-day based on increased organ weights. The NOAEL of 50 mg/kg-day will be used to derive an oral reference dose and drinking water guidance value for alcohols, C_{6-12}, ethoxylated propoxylated and alcohols, C_{10-16}, ethoxylated propoxylated.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:
UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 1
UF_D (database uncertainty) = 1

Oral RfD = 50/(10 x 10 x 1 x 10 x 1) = 50/100 = 0.5 mg/kg bw/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:
Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.5 x 70 x 0.1)/2 = 1.8 mg/L

Cancer

There were no available studies for alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated. Thus, a cancer reference value was not derived.

K. Human Health Hazard Assessment of Physico-Chemical Properties

Alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated do not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

7 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated have a low toxicity concern to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies on alcohols, C_{6-12}, ethoxylated propoxylated, alcohols and C_{10-16}, ethoxylated propoxylated. No data was available for alcohols, C_{16-18}, ethoxylated propoxylated.

Table 3 Acute Aquatic Toxicity Studies on alcohols, C_{6-12}, ethoxylated propoxylated and alcohols, C_{10-16}, ethoxylated propoxylated

Substance	Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
C_6-C_{12}	*Danio Rio*	96-hr LC_{50}	1-10	-	MilliporeSigma, 2026
	Pimephales promelas (fathead minnow)	96-hr LC_{50}	22.5	-	Univar, 2025
	Daphnia magna	48-hr EC_{50}	1-10	-	MilliporeSigma, 2026
	Daphnia magna	48-hr EC_{50}	14.4		Univar, 2025
	Selenastrum capricornutum	72-hr EC_{50}	1-10	-	MilliporeSigma, 2026
C_{10}-C_{16}	*Danio Rio*	96-hr EC_{50}	1-10	-	MilliporeSigma, 2026
	Daphnia magna	48-hr EC_{50}	1.45-1.79	-	MilliporeSigma, 2026
	Desmodesmus subspicatus (green algae)	72-hr EC_{50}	2.58-3.44	-	MilliporeSigma, 2026

Chronic Studies

No chronic studies were available for fish or invertebrates. In a non-guideline study conducted on *Selenastrum capricornutum* (green algae) a 72-hour NOEC of 1.7 mg/L was determined for alcohols, C_{6-12}, ethoxylated propoxylated (MilliporeSigma, 2026).

In developing a water quality guideline for read-across and more toxic analogue AEs (ANZG, 2018), the toxicity data were normalised for a specific alkyl chain length or a specific number of EO groups. The NOECs were normalised to an alkyl chain length of C13.3 and EO of 8.2. There were chronic data for 13 species that belonged to 7 taxonomic groups (fish, crustacea, blue alga, diatoms, green alga, protozoa and worms): Freshwater fish: 2 species, 720 to 1,500 µg/L, freshwater crustaceans: 2 species, 590 to 860 µg/L, freshwater rotifers: 1 species, *Brachionus calyciflorus*, 1,300 µg/L, freshwater algae, diatoms and blue-green algae: 6 species, 200 to 8,700 µg/L, freshwater mesocosms: 4 NOEC data for multiple species tests were 80, 80, 320 and 330 µg/L, although replication was insufficient to meet OECD (1992) requirements. Normalised data were 380, 380, 320 and 1,520 µg/L.

C. Terrestrial Toxicity

No studies are available. The substances are readily biodegradable. Therefore, soil is not expected to be a compartment of concern. Thus, the risk to terrestrial macroorganisms is regarded to be negligible (ECHA).

D. Calculation of PNEC

The PNEC calculations for alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated follow the methodology discussed in DEWHA (2009).

PNEC water

The ANZG water quality guideline (2018) in freshwater is: “A high reliability trigger value of 140 µg/L was derived for AE (normalized data) using the statistical distribution method with 95% protection.”

PNEC sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, a $PNEC_{sed}$ was calculated using the equilibrium partitioning method representative of both alcohols. The $PNEC_{sed}$ is 0.11mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= 0.994/1280 \times 1000 \times 0.14$
$= 0.11$ mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 kg/m^3[default]
$PNEC_{water}$ = 0.14 mg/L

$K_{sed\text{-}water}$ = 0.8 + [(0.2 x Kp_{sed})/1000 x BD_{solid}]
= 0.8 + [(0.2 x 0.404)/1000 x 2400]
= 0.994 m^3/m^3

And:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 kg/m^3[default]

Kp_{sed} = K_{oc} x f_{oc}
= 10.1 x 0.04
= 0.404 L/kg

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg).). The lowest K_{oc} for alcohols, $C_{6\text{-}12}$, ethoxylated propoxylated calculated from EPISUITE™ using the MCI is 10.1 L/kg.
f_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC soil

There are no toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method representative of both alcohols. The $PNEC_{soil}$ is 0.019 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil}$ = (Kp_{soil}/BD_{soil}) x 1000 x $PNEC_{water}$
= (0.202/1500) x 1000 x 0.14
= 0.019 mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 kg/m^3 [default]

Kp_{soil} = K_{oc} x f_{oc}
= 10.1 x 0.02
= 0.202 m^3/m^3

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The lowest K_{oc} for alcohols, $C_{6\text{-}12}$, ethoxylated propoxylated calculated from EPISUITE™ using the MCI is 10.1 L/kg.
f_{oc} = fraction of organic carbon in soil = 0.02 [default].

8 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated are readily biodegradable; thus, they do not meet the screening criteria for persistence.

The estimated bioconcentration factors (BCF) in fish for alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated range from 3.3 to 1,87. Thus, alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated do not meet the criteria for bioaccumulation.

The lowest chronic NOEC for alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated is >0.1 mg/L. Thus, alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated do not meet the screening criteria for toxicity.

The overall conclusion is that alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated are not PBT substances.

B. Other Characteristics of Concern

No other characteristics of concern were identified for alcohols, C_{6-12}, ethoxylated propoxylated, alcohols, C_{10-16}, ethoxylated propoxylated and alcohols, C_{16-18}, ethoxylated propoxylated.

9 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required [3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity [2]	
Alcohols, C_{6-12}, ethoxylated propoxylated	68937-66-6	Not a PBT	No	No	No	No	No	No	2	1	2
Alcohols, C_{10-16}, ethoxylated propoxylated	69227-22-1	Not a PBT	No	No	No	No	No	No	2	1	2
Alcohols, C_{16-18}, ethoxylated propoxylated	68002-96-0	Not a PBT	No	No	No	No	No	No	2	1	2

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 3 - Quantitative Risk Assessment: Complete PBT, qualitative and quantitative assessment of risk.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

10 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
ADWG	Australian Drinking Water Guidelines
AICS	Australian Inventory of Chemical Substances
COC	constituent of concern
DEWHA	Department of the Environment, Water, Heritage and the Arts
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
HHRA	enHealth Human Risk Assessment
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
Kl	Klimisch scoring system
KOCWIN™	USEPA organic carbon partition coefficient estimation model
kPa	kilopascal
L	litre
L/kg	litres per kilogram
LC	lethal concentration
LD	lethal dose
LOAEL	lowest observed adverse effect level

m^3	cubic metre
MCI	molecular connectivity index
mg/kg	milligrams per kilogram
mg/L	milligrammes per litre
mg/m^3	milligrams per cubic metre
mL	millilitre
mPa s	millipascal second
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
NOAEL	no observed adverse effect level
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RfD	Reference Dose
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

ALCOHOLS, C6-C10, ETHOXYLATED (CAS RN 70879-83-3)
ALCOHOLS, C11-14-ISO-, C13-RICH, ETHOXYLATED (CAS RN 78330-21-9)
ETHYOXYLATED C12-C14 ALCOHOL (CAS RN 84133-50-6)
ETHYOXYLATED C12-C15 ALCOHOL (CAS RN 68131-39-5)
ETHYOXYLATED C12-C16 ALCOHOL (CAS RN 68551-12-2)
POLY(OXY-1,2-ETHANEDIYL), .ALPHA.-DODECYL-.OMEGA. HYDROXY- (CAS RN 9002-92-0)

This group contains six alcohol ethoxylates (AEs). They are expected to have similar environmental concerns and have consequently been assessed as a group.

This dossier on AEs presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The information presented in this dossier was obtained primarily from the Human & Environmental Risk Assessment on Ingredients of European Household Cleaning Products: Alcohol Ethoxylates (HERA, 2009), and from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – These AEs were not identified in chemical databases used by NICNAS as an indicator that the chemicals are of concern and are not PBT substances. The AEs were assessed as tier 2 chemicals for acute toxicity of fish, tier 3 chemicals for acute toxicity of invertebrates and algae, and tier 2 chemicals for chronic toxicity of fish, invertebrates and algae. Based on their potential for rapid degradation in the environment, they are not expected to pose a substantial toxic concern to environmental receptors. Therefore, these substances are classified overall **tier 2** chemicals and require a hazard assessment and qualitative assessment of risk.

1 BACKGROUND

AEs are a class of non-ionic surfactants that have the basic structure $C_{x\text{-}y}AE_n$. The subscript (x-y) following the 'C' indicates the range of carbon chain units. The hydrocarbon chain can be either linear or branched. AEs also contain an ethylene oxide (E) chain attached to the alcohol. The degree of ethylene oxide (EO) polymerisation is indicated by the subscript (n) which indicates the average number of EO units. For example,

- Ethoxylated branched C13 alcohol (CAS No. 78330-21-9) has an average number of 1 to 7 moles of EO units.
- Ethoxylated C12-C15 alcohol (CAS RN 68131-39-5) has an average number of 1 to 2.5 moles of ethylene oxide units.
- Ethoxylated C12-C16 alcohol (CAS RN 68551-12-2) has an average number of 1 to 6 moles of ethylene oxide units.
- Poly(oxy-1,2-ethanediyl), .alpha.-dodecyl-.omega. hydroxy (CAS RN 9002-92-0) has an average number of 1 to 2.5 moles of ethylene oxide units.

The sorption potential for AEs varies based on the AE and level of ethoxylation. The group members are readily biodegradable and have a low potential for bioaccumulation.

The acute toxicity of AEs is low by the oral and dermal routes. The skin irritation rabbit studies have shown mixed results, but human patch studies on these AEs do not support a skin irritant

classification. However, AEs are expected to be irritating to the eyes of rabbits. They are not skin sensitisers. Repeated dose toxicity studies on similar AEs in rats do not indicate any target organ effects. These AEs are not genotoxic, carcinogenic, and have a low potential for reproductive and developmental toxicity.

The aquatic toxicity of AEs has been extensively evaluated in numerous studies on fish, daphnids and algae as well as microorganisms. A review of the acute studies indicates that invertebrates are somewhat more sensitive to AEs than fish and algae. AEs have moderate chronic toxicity to aquatic life. They are not toxic to terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Alcohols, C6-10, ethoxylated

CAS RN:70879-83-3

Molecular formula: $–(CH_2)_{6\text{-}10}–(OCH_2CH_2)_n–OH$ (where n is the average number of EO units)

Molecular weight: Unspecified (Substance is a UVCB)

Synonyms: (C6-C10) alkyl alcohol, ethoxylated

Chemical Name (IUPAC): Alcohols, C11-14 -iso, C13-rich ethoxylated

CAS RN:78330-21-9

Molecular formula: $–(CH_2)_{11\text{-}14}–(OCH_2CH_2)_n–OH$ (where n is the average number of EO units)

Molecular weight: Unspecified (Substance is a UVCB)

Synonyms: Ethoxylated C11-14-iso, C13 rich alcohol; ethoxylated branched C11-14, C13-rich alcohols; alpha-Alkyl-omega-hydroxypoly(oxypropylene) and/or poly(oxyethylene) polymers where the alkyl chain contains a minimum of six carbons, minimum number average molecular weight (in amu) 1,100

Chemical Name: Alcohols, C12-14, ethoxylated

CAS RN: 84133-50-6

Molecular formula: $H–(CH_2)_{12–14}–(OCH_2CH_2)_n–OH$ (where n is the average number of EO units)

Molecular weight: Unspecified (Substance is a UVCB)

Synonyms: Secondary alcohols, C12-14, ethoxylated

Chemical Name (IUPAC): Alcohols, C12-15, ethoxylated

CAS RN: 68131-39-5

Molecular formula: $H–(CH_2)_{12–15}–(OCH_2CH_2)_n–OH$ (where n is the average number of EO units)

Molecular weight: Unspecified (Substance is a UVCB)

Synonyms: Ethoxylated C12-15 alcohols

Chemical Name (IUPAC): Alcohols, C12-16, ethoxylated

CAS RN: 68551-12-2

Molecular formula: $H–(CH_2)_{12–16}–(OCH_2CH_2)_n–OH$ (where n is the average number of EO units)

Molecular weight: Unspecified (Substance is a UVCB)

Synonyms: Ethoxylated C12-16 alcohols; polyethylene glycol, dodecyl, tetradecyl, hexadecyl ether

Chemical Name (IUPAC): Poly(oxy-1,2-ethanediyl), .alpha.-dodecyl-.omega.-hydroxy-

CAS RN: 9002-92-0

Molecular formula: $(C_2H_4O)_nC_{12}H_{26}O$

Molecular weight: Unspecified (Substance is a UVCB)

Synonyms: dodecyl alcohol, monoether with polyethylene glycol; ethoxylated lauryl alcohol; glycols, polyethylene monododecyl ether; polypropylene glycol monododecyl ether

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the AE group based on a representative group member are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Ethoxylated C12-15 Alcohols

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Clear liquid	2	ECHA
Melting Point	7.22°C (pressure not provided)	2	ECHA
Boiling Point	271.11-516.11°C @ 101.3 kPa	2	ECHA
Density	926 kg/m^3 @ 15.56°C	2	ECHA
Vapor Pressure	Negligible	-	ECHA
Partition coefficient (log K_{ow})	5.06* @ 25°C	2	ECHA
Dissociation constant (pKa)	No dissociation	-	ECHA

Property	Value	Klimisch score	Reference
Water Solubility	0.021 g/L @ 20°C	1	ECHA
Viscosity	27 mPA s (dynamic) @ 20°C	2	ECHA

*Based on alcohols, C12-14, ethoxylated (1 to 2.5 EO) [CAS RN 68439-50-9]

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for these AEs.

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

The sorption potential for AEs varies based on the AE and level of ethoxylation. The group members are readily biodegradable and have a low potential for bioaccumulation.

B. Biodegradation

AE homologues with linear hydrocarbon chain lengths from C8 to C15 and mean values ranging from 3-20 EO units are readily biodegradable (HERA, 2009). If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

Ethoxylated C12-C14 alcohol(7-8) degraded to 100% in 28 days in a Die-away Screening Test (HERA, 2009) [Kl. Score = 2].

Ethoxylated C12-C15 alcohol is readily biodegradable. In an OECD 301B test, degradation was 72% in 28 days, but failed the 10-day window criteria (ECHA) [Kl. score = 1].

Ethoxylated C12-C15 alcohol (7 EO) degraded 80 to 88% in 28 days when tested using a shake-flask CO_2-evolution test method (ECHA) [Kl. score = 2].

Polypropylene glycol monododecyl ether degraded 74, 44 and 62% by BOD, TOC removal and UV-Vis parameter in 28 days in an OECD 301C Guideline test (ECHA) [Kl. score = 2].

C. Environmental Distribution

In an OECD Guideline 121 (Estimation of the Adsorption Coefficient (Koc) on Soil and on Sewage Sludge using High Performance Liquid Chromatography (HPLC)) study conducted on polypropylene glycol monododecyl ether, a soil organic carbon partition coefficient (K_{oc}) value of 44 L/Kg was determined (ECHA). [Kl. score = 1] Based on this K_{oc} value, the substance has a low potential for sorption to soil.

For other AEs in this group, the K_{oc} has been estimated according to a specific QSAR method developed for alcohol ethoxylates from measured sorption data by van Compernolle et al. (2006) (HERA, 2009). The work by these authors investigated the adsorption of several radio-labelled specific alcohol ethoxylate homologues onto activated sludge and river water solids. These results, together with results from validated published and unpublished work, were used to derive a K_{oc}-based sorption QSAR. The experimental data used to develop these QSARs covers the EO range from 0 to 10, with good coverage for the alcohols in this group. The K_{oc} values estimated according to the method of van Compernolle et al. (2006) ranged from 370 L/kg for $C_{10}AE_3$ to 172,982 for $C_{16}AE_6$. [Kl. score = 2]

Using KOCWIN in EPISuite™, estimated K_{oc} values are:

- ethoxylated C12-C16 alcohol: 3,920 L/kg (MCI) and 13,530 L/kg (log K_{ow}).
- C12 linear alcohol, ethoxylated (2 EO): 279.5 L/kg (MCI) and 464.2 L/kg (K_{ow})
- C15 linear alcohol, ethoxylated (2 EO): 1,691 L/kg (MCI) and 3,018 L/kg (K_{ow})

Based on these K_{oc} values, if released to soil, the substance is expected to strongly adsorb to soil and have a low potential for mobility.

D. Bioaccumulation

The potential for bioaccumulation of AEs is considered low due to the biotransformation and excretion of the substance. The various studies present considerable evidence that AEs are rapidly eliminated and metabolised (ECHA).

The BCF values for AEs in fathead minnows have been reported to range from <5 to 387.5 (Toll et al., 2000). The uptake rates varied from 330 to 1660 (L x kg/day) and elimination rates varied from 3.3 to 59 per day (Toll et al., 2000). The high concentrations in fish are thought to be prevented by an efficient biotransformation of the AEs, leading to a high elimination rate.

6 HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

The acute toxicity of AEs is low by the oral and dermal routes. The skin irritation rabbit studies have shown mixed results, but human patch studies on these alcohol ethoxylates do not support a skin irritant classification. However, AEs are expected to be irritating to the eyes of rabbits. They are not a skin sensitiser. Repeated dose toxicity studies on similar alcohol ethoxylates in rats do not indicate any target organ effects. These alcohol ethoxylates are not genotoxic, carcinogenic, and have a low potential for reproductive and developmental toxicity.

B. Toxicokinetics

In rats, AEs are readily absorbed in the gastrointestinal tract (i.e., oral absorption has been estimated to be >75%) and rapidly excreted via the urine and faeces after oral application. The alkyl chain length appears to have an impact on the metabolism. AEs with longer alkyl chains are excreted at a higher proportion into expired air and less in urine. Also, ethoxy chain length impacts the proportions excreted via the urine, the faeces, and the expired air with more being excreted via the faeces and expired in the air with longer ethoxy chain length (HERA, 2009).

The same trends were observed when AEs were administered dermally, with the only difference being that adsorption was slower and less of the total administered compound was absorbed (HERA, 2009).

C. Acute Toxicity

The oral LD_{50} in rats for $C_{12\text{-}15}AE_3$ is >5,000 mg/kg (ECHA) [Kl. score = 2]. The oral LD_{50} in rats for $C_{12\text{-}15}AE_7$ is 1,700 mg/kg (HERA, 2009) [Kl. score = 2]. The oral LD_{50} value in rats for $C_{12\text{-}13}AE_{6.5}$ is 2,100 mg/kg (HERA, 2009) [Kl. score = 2]. The oral LD_{50} value in rats for $C_{12\text{-}15}AE_{11}$ is >2,000 mg/kg in males and between 1,000 and 2,000 mg/kg in females (HERA, 2009) [Kl. score = 2]. The oral LD_{50} values in rats for $C_{14\text{-}15}AE_{13}$ in two separate studies are 1,100 and 1,000 mg/kg (HERA, 2009) [Kl. score = 2]. The relative number of EO units, but not the carbon chain length, appears to influence acute oral toxicity (HERA, 2009).

Acute dermal LD_{50} values of >2,000 mg/kg were determined for $C_{12\text{-}14}AE_3$ and $C_{12\text{-}14}AE_6$ in two separate studies (HERA, 2009) [Kl. score = 2]. The acute dermal LD_{50} of $C_{12\text{-}15}AE_7$ is >2,000 mg/kg (HERA, 2009) [Kl. score = 2].

D. Irritation

Skin

Application of 0.5 mL isotridecanol, ethoxylated (3 EO) to the skin of rabbits for 4 hours under occlusive conditions was considered irritating (ECHA) [Kl. score = 2].

Application of 0.5 mL isotridecanol, ethoxylated (3 EO) to the skin of rabbits for 4 hours under semi-occlusive conditions was not considered irritating (ECHA) [Kl. score = 2].

In a 24-hour human patch test, there was some short-lived redness in some individuals from the application of $C_{12-14}AE_3$, but there was no scaling or edema in any subjects (HERA, 2009) [Kl. score = 2].

In a standard 4-hour human patch test, the irritation potential of $C_{12-15}AE_5$ and $C_{12-15}AE_5$ were compared to 20% sodium dodecyl sulfate (which is classified a skin irritant under GHS). The results showed that neither alcohol ethoxylate should be classified as a skin irritant (Basketter et al., 2004) [Kl. score = 2]. Nonetheless, the substance is classified by ECHA as an irritant.

Eye

Most alcohol ethoxylates tested as the undiluted neat test material are moderately to severely irritating to the eyes of rabbits, with an eye irritation index (EII) ranging from >25 to 50 (HERA, 2009). The alcohol ethoxylates $C_{12-14}AE_3$, $C_{12-14}AE_6$, $C_{13}AE_6$, and $C_{12-14}AE_{10}$ were found to be moderately to severely irritating to the eyes of rabbits (HERA, 2009). In another study, $C_{12-15}AE_{11}$ was considered moderately to severely irritating to the eyes of rabbits (HERA, 2009).

Some alcohol ethoxylates were reported to be practically or minimally irritating to the eyes of rabbits with EII scores of 0.5 to 15. These alcohol ethoxylates include: $C_{12-15}AE_3$, $C_{14-15}AE_7$, $C_{12-14}AE_{15}$, $C_{14-15}AE_{18}$, and $C_{13}AE_{20}$ (HERA, 2009).

E. Sensitisation

In a guinea pig maximisation test, $C_{12-13}AE_{<2.5}$ (CAS RN 66455-14-9) was not considered a skin sensitiser (ECHA) [Kl. score = 2].

In a guinea pig maximisation test, $C_{12-15}AE_3$, $C_{12-15}AE_7$, and $C_{14-15}AE_7$ were not considered skin sensitisers (HERA, 2009) [Kl. scores = 2].

F. Repeated Dose Toxicity

Oral

Rats were fed 0%, 0.0313%, 0.0625%, 0.125%, 0.25%, 0.5% and 1.0% $C_{12-14}AE_7$ in their diets for 90 days. The animals in the ≥0.25% groups showed significantly reduced body weight gain, which was associated with marked decreases in food and water consumption. Relative liver weights were significantly increased in the ≥0.5% male rats and ≥0.25% females. Histopathologic examination showed hepatocytic enlargement in the ≥0.125% groups, suggesting increased liver metabolism based on increased alkaline phosphatase activity at the higher dose levels. The NOAEL was established at 0.0625% in the diet or 110 mg/kg-day (HERA, 2009) [Kl. score = 2].

Male and female Wistar rats were fed 0, 300, 1,000, 3,000, and 10,000 ppm $C_{14-15}AE_7$ in their diets for 90 days. There were no deaths during the study. Mean body weights and feed were lower in 10,000 ppm males and the 3,000 ppm females. Relative liver weights were increased in the ≥3,000 ppm animals, and relative spleen weights were increased in the 10,000 ppm males. Clinical chemistry changes were noted in the 10,000 ppm group and consisted of significantly higher urea, chloride and potassium levels in males; significantly higher urea, chloride and cholesterol in females. Increased total leucocytes and lymphocytes were seen in the 10,000 ppm animals and in the 3,000 ppm males. The 10,000 ppm females showed lower numbers of neutrophils; mean cell volume and mean cell hemoglobin were identified in one or both sexes fed in the ≥3,000 ppm dose groups. In

the 1,000 ppm females, there were minor, but statistically significant changes in the liver and kidney weights and plasma urea concentration; these effects were of no toxicological significance. Histopathologic examination showed no treatment-related effects at any dose level. The NOAEL for this study is 1,000 ppm in the diet, which corresponded to 50 mg/kg-day (HERA, 2009) [Kl. score = 2].

Rats were fed 0, 0.1, 0.5, or 1% $C_{14\text{-}15}AE_7$ in their diets for 90 days. Body weights, food intake, organ weights, and hematology and clinical chemistry parameters were similar across groups. The NOAEL for this study is 1% in the diet, which corresponded to 700 and 785 mg/kg-day for males and females, respectively (HERA, 2009) [Kl. score = 2].

Rats were fed 0, 0.1, 0.5 or 1% $C_{12\text{-}13}AE_{6.5}$ or $C_{14\text{-}15}AE_7$ in their diets for two years. Body weight gain was reduced in the 1% males and ≥0.5% females, which was likely due to the reduced food consumption in these animals. At study termination, organ to body weight ratios were increased in the ≥0.5% females (liver, kidney and brain), 1% females (heart), and 1% males (liver). A dose-related focal myocarditis was observed in males. While focal myocarditis is commonly observed in non-treated aging rats, the incidence in the treated animals were higher than in the controls. The NOAEL was established at 0.1% or 50 mg/kg-day (HERA, 2009) [Kl. score = 2].

Male and female CR rats were fed 0.1, 0.5 and 1% $C_{14\text{-}15}AE_7$ in their diets for two years. A treatment-related body weight depression was observed in females at the two highest treatment levels and in males at the 1% dose level, probably due to the poor palatability of the diet. Relative liver, kidney, heart, and thyroid/parathyroid gland weights were increased in the 1% dietary group at study termination. Histopathological examination showed a dose-related increase in the incidence of focal myocarditis at the 12-month time point, but not at the end of the study at two years. The NOAEL for this study was 0.5% in the diet, which corresponded to 162 and 190 mg/kg-day for males and females, respectively (HERA, 2009) [Kl. score = 2].

Inhalation

No studies are available.

Dermal

No adequate studies are available.

G. Genotoxicity

In Vitro Studies

The genotoxicity studies conducted on alcohol ethoxylates are reviewed in HERA (2009). The results of several *in vitro* studies for similar AEs are presented below in Table 3.

Table 3 *In Vitro* Genotoxicity Studies on Selected Alcohol Ethoxylates

Test Substance	Test System	Results*		Klimisch Score	References
		-S9	+S9		
$C_{14\text{-}15}AE_7$	Bacterial reverse mutation (*S. typhimurium* strains)	-	-	2	HERA, 2009

Test Substance	Test System	Results*		Klimisch Score	References
		-S9	+S9		
$C_{14\text{-}15}AE_7$	Bacterial reverse mutation (*S. typhimurium* strains)	-	-	2	HERA, 2009
$C_{14}AE_{12}$	Chromosomal aberrations (CHO cells)	-	-	2	HERA, 2009

*+, positive; -, negative

In Vivo Studies

In two separate studies, CD-1 mice were given an intraperitoneal dose of 0, 50, or 100 mg/kg $C_{12\text{-}15}AE_3$ or $C_{12\text{-}14}AE_9$. There were no increases in the frequency of micronuclei in the bone marrow cells (Talmage, 1994) [Kl. score = 2].

Male and female Tunstall rats were given a single oral gavage dose of 0, 250, 500, or 1,000 mg/kg $C_{14\text{-}15}AE_7$. There were no increases in chromosomal aberrations in the bone marrow cells (HERA, 2009 [Kl. score = 2].

H. Carcinogenicity

Male and female Sprague-Dawley rats were fed $C_{12\text{-}13}AE_{6.5}$ in their diets at doses up to 1% (500 mg/kg-day). Reduced food consumption was noted at the higher dose levels (*i.e.*, 0.5 and 1% for females and 1% for males), resulting in a lower body weight gain compared to the control group. No treatment-related histopathology was found and no increase in tumour incidence (HERA, 2009) [Kl. score = 2].

Male and female Charles River rats were fed 0, 0.1, 0.5 or 1% $C_{14\text{-}15}AE_7$ in their diets for two years. There were no treatment-related changes in general behaviour and appearance. The survival rate of the test animals was comparable, if not better than the controls. Body weights of the 0.5% females and the 1% males and females had significantly lower weight gains than the control. There were no treatment-related effects on organ weights and tumour incidence (HERA, 2009) [Kl. score = 2].

Male and female Sprague-Dawley rats were fed 0.1, 0.5 and 1% $C_{14\text{-}15}AE_7$ in their diets for two years. A treatment-related body weight depression was observed in females at the two highest treatment levels and in males at the 1% dose level, probably due to the poor palatability of the diet. There was no evidence for any carcinogenic activity (HERA, 2009) [Kl. score = 2].

I. Reproductive Toxicity

CD rats were fed 0, 0.05, 0.1 or 0.5% (approximately 0, 25, 50 or 250 mg/kg-day) $C_{12}AE_6$ in their diets in a two-generation reproductive toxicity study. There were no treatment related effects in the parents or pups on general behaviour, appearance or survival. At 0.5%, there was reduced weight gain in both the parental animals and the pups compared to the controls. Fertility was unaffected by treatment. The NOAEL for reproductive toxicity is 0.5%, which corresponds to 250 mg/kg-day (HERA, 2009) [Kl. score = 2].

In a two-generation developmental and teratogenicity study, CD rats were fed 0, 0.05, 0.1 or 0.5% $C_{14\text{-}15}AE_7$ (approximately 0, 25, 50 or 250 mg/kg-day) in their diets. Three of the treated groups were given the test substance continuously throughout the study; in the other three groups the females received the test substance on GD 6-15 and the males were untreated. The deaths of parental rats during the study were not considered to be compound related. There were no treatment-related changes in behaviour or appearance in the parental rats or pups. Slightly lower body weight gain was noted in the 0.5% continuously treated females. Food consumption was similar for control and treated rats. Fertility, gestation and viability indices were similar across groups. The average 21-day body weights for the 0.5% continuous treated pups were significantly lower than that of the control. Relative liver weights of the 0.5% continuously treated F_1 parental animals were increased at the 91-day sacrifice; relative liver weights of the 0.5% continuously treated males were also increased at the 60-day and caesarean section sacrifices. There were no treatment-related histopathological lesions in any of the tissues from the F_0 and F_1 generations. The NOAEL for reproductive toxicity is 0.5% or 250 mg/kg-day (HERA, 2009) [Kl. score = 2].

J. Developmental Toxicity

In a two-generation reproductive toxicity study, Charles River rats were fed 0, 0.05, 0.1 or 0.5% (about 0, 25, 50 or 250 mg/kg-day) $C_{12}AE_6$ in their diets. General behaviour, appearance and survival were unaffected by treatment. At the 0.5% dose level, adults and pups gained less weight than the control rats. In the 0.5% dose group, there was a statistical increase in embryo lethality and soft tissue anomalies and at the 0.1%, there was a statistical decrease in mean foetal liver weight. Neither of these effects were considered to be treatment-related by the authors as they showed no dose response characteristics. The NOAEL for maternal toxicity is 50 mg/kg-day. The NOAEL for developmental and teratogenicity is 0.1% or 50 mg/kg-day (HERA, 2009) [Kl. score = 2].

Pregnant rabbits were given 0, 50, 100 or 200 mg/kg $C_{12}AE$ by oral gavage from gestational days 2 to 16. Nine control rabbits and 31 treated rabbits died during the study. Surviving rabbits at the 200 mg/kg dose group generally showed slight losses of body weight. At 100 and 200 mg/kg, ataxia and a slight decrease in body weight was observed in the pregnant animals. In seven treated and two control rabbits, early deliveries were recorded. There were no treatment-related effects on corpora lutea, implantations, number of live foetuses and spontaneous abortions. The NOAEL for maternal toxicity is 50 mg/kg-day; the NOAEL for developmental toxicity is 200 mg/kg-day (HERA, 2009) [Kl. score = 2].

K. Derivation of Toxicological Reference and Drinking Water Guidance Values

The toxicological reference values developed for the AEs follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

Non-Cancer

Two-year dietary studies in rats have been conducted on alcohol ethoxylates $C_{12\text{-}13}AE_{6.5}$ and $C_{14\text{-}15}AE_7$ (HERA, 2009). The lowest NOAEL from these studies is 50 mg/kg-day based on increased organ weights. The NOAEL of 50 mg/kg-day will be used to derive an oral reference dose and drinking water guidance value for AE group members.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 1
UF_D (database uncertainty) = 1

Oral RfD = 50/(10 x 10 x 1 x 1 x 1) = 50/100 = 0.5 mg/kg-day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)

Drinking water guidance value = (0.5 x 70 x 0.1)/2 = 1.8 mg/L

Cancer

Several alcohol ethoxylates similar to AE group members were not carcinogenic to rats in a two-year dietary study. Thus, a cancer reference value was not derived.

L. Human Health Hazard Assessment of Physico-Chemical Properties

AE group members do not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidizing potential

7 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

The aquatic toxicity of AEs has been extensively evaluated in numerous studies on fish, daphnids and algae as well as microorganisms. A review of the acute studies indicates that invertebrates are somewhat more sensitive to AEs than fish and algae. AEs have moderate chronic toxicity to aquatic life. AEs are not toxic to terrestrial organisms.

B. Aquatic Toxicity

According to the available information, acute ecotoxicity endpoints (median effective concentration (EC50) or median lethal concentration (LC50)) vary between ~0.05 mg/L to more than 100 mg/L and chronic endpoints (effect concentration (EC10) or no observed effect concentration (NOEC)) vary between 0.03 mg/L and 9.8 mg/L. Chemicals with alkyl chain lengths between C6 and C11 are generally not toxic based on acute endpoints greater than 1 mg/L and chronic endpoints greater than 0.1 mg/L. Chemicals with alkyl chain lengths between C12 and C16 are generally toxic with acute endpoints between 0.1 mg/L and 10 mg/L and chronic endpoints between 0.01 mg/L and 1 mg/L. Available data for C18 ethoxylates indicate low acute toxicity to fish and invertebrates, with all endpoints higher than 1 mg/L (AICIS, 2025).

Acute Studies

The aquatic toxicity of AEs has been extensively evaluated in numerous studies on fish, daphnids and algae as well as microorganisms. A review of the acute studies indicates that invertebrates are somewhat more sensitive to AEs than fish and algae. As concluded in HERA (2009), the Danish EPA (2001) found that the acute toxicity of AEs to invertebrates varies, with EC_{50} values from 0.1 mg/l to more than 100 mg/l for linear AE and from 0.5 mg/l to 50 mg/l for branched AEs. The toxicity is species specific and may vary between 0.29 mg/l and 270 mg/l for the same linear AEs (Lewis and Suprenant 1983, quoted in Danish EPA 2001). The most commonly used invertebrates for testing are Daphnia magna and Daphnia pulex, and they are also among the most sensitive invertebrates to AEs. The Danish EPA (2001) found that some AEs are very toxic to invertebrates, i.e., linear AEs of C12-15 EO1-8 and branched AEs with a low degree of branching, i.e. < 10-25%. They concluded that branching of the alkyl chain reduces the toxicity of AEs to invertebrates, as also observed for algae (Danish EPA 2001). However, the data used for this conclusion was from specially synthesized AE, which have a significantly higher toxicity than AEs used commercially (Kaluza and Taeger, 1996).

Table 4 lists the results of acute aquatic toxicity studies on representative group member ethoxylated C12-C15 alcohol and read-across substances ethoxylated C12-C14 alcohol (2 EO) [CAS RN 68439-50-9] and alcohols, C12-C15, branched and linear, ethoxylated [CAS RN 106232-83-1].

Table 4 Acute Aquatic Toxicity Studies on Ethoxylated C12-C15 Alcohol and Ethoxylated C12-C16 Alcohol[a,b,c]

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Oncorhynchus mykiss (Rainbow Trout)	96-hr LC_{50}	1.3 – 1.7[a]	2	ECHA
Danio Rio	96-hr LC_{50}	1.2[b]	2	ECHA
Danio Rio	96-hr LC_{50}	2[b]	2	ECHA
Zebrafish	96-hr LC_{50}	>2[c]	2	ECHA
Daphnia magna	48-hr EC_{50}	0.14[a]	2	ECHA
Daphnia magna	48-hr EC_{50}	0.23[a]	2	ECHA
Daphnia magna	48-hr EC_{50}	0.53[b]	2	ECHA
Daphnia magna	48-hr EC_{50}	2.84[b,d]	2	ECHA

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Daphnia magna	48-hr EC_{50}	1.2[e]	1	ECHA
Daphnia magna	48-hr EC_{50}	>2[b]	2	ECHA
Daphnia magna	48-hr EC_{50}	>2[c]	2	ECHA
Daphnia magna	48-hr EC_{50}	0.23	2	ECHA
Pseudokirchneriella subcapitata	72-hr EC_{50}	0.75[a]	2	ECHA
Pseudokirchneriella subcapitata	72-hr EC_{50}	>2[c]	2	ECHA
Pseudokirchneriella subcapitata	72-hr EC_{50}	0.41[b]	2	ECHA
Desmodesmus subspicatus (green algae)	72-hr EC_{50}	0.778[b]	2	ECHA
Desmodesmus subspicatus (green algae)	72-hr EC_{50}	0.87[e]	1	ECHA
Desmodesmus subspicatus (green algae)	72-hr EC_{50}	1.3[e]	1	ECHA

a: ethoxylated C12-C15 alcohol
b: Read across to ethoxylated C12-C14 alcohol (EO 2) CAS RN 68439-50-9
c: Read across to alcohols, C12-C15, branched and linear, ethoxylated (CAS RN 106232-83-1)
d: ethoxylated C12-C14 alcohol (EO 1) CAS RN 68439-50-9 as WAF (water accommodated fraction)
e: ethoxylated C12-C14 alcohol (EO 4 or EO 6) CAS RN 68439-50-9

Chronic Studies

In developing a water quality guideline for AEs (ANZG, 2018), the toxicity data was normalised for a specific alkyl chain length or a specific number of EO groups. The NOECs listed below were normalised to an alkyl chain length of C13.3 and EO of 8.2. There were chronic data for 13 species that belonged to 7 taxonomic groups (fish, crustacea, blue alga, diatoms, green alga, protozoa, and worms).

Freshwater fish: 2 species, 720 to 1,500 µg/L.

Freshwater crustaceans: 2 species, 590 to 860 µg/L.

Freshwater rotifers: 1 species, *Brachionus calyciflarus*, 1,300 µg/L.

Freshwater algae, diatoms and blue-green algae: 6 species, 200 to 8,700 µg/L.

Freshwater mesocosms: 4 NOEC data for multiple species tests were 80, 80, 320 and 330 µg/L, although replication was insufficient to meet OECD (1992) requirements. Normalised data were 380, 380, 320 and 1,520 µg/L.

C. Terrestrial Toxicity

AEs are not toxic to terrestrial organisms. Acute toxicity data for soil invertebrates (*E. foetida, Folsomia candida, Caenorhabditis elegans and Heterocypris incongruens*) are available for the pure homologues C8EO4, C12EO4, commercial C12EO10 and the fatty alcohols 1-decanol (C10) and 1-tetradecanol (C14). Measured EC_{50} values were between 98 mg/kg and 850 mg/kg or above the highest test concentration of 1000 mg/kg. Chronic toxicity data for soil invertebrates (*E. foetida*, *F. candida* and *C. elegans*) are available for the pure homologues C12EO4 and C16EO4. Measured NOEC values for adult mortality and reproduction were between 220 mg/kg and 1000 mg/kg (AICIS, 2025).

D. Calculation of PNEC

The PNEC calculations for AEs follow the methodology discussed in DEWHA (2009).

PNEC $_{water}$

The ANZG water quality guideline (2018) in freshwater is: "A high reliability trigger value of 140 µg/L was derived for AE (normalized data) using the statistical distribution method with 95% protection."

PNEC $_{sediment}$

There are no toxicity data for sediment-dwelling organisms. Nonetheless, a $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 8.32 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$

$= 76.064/1280 \times 1000 \times 0.14$

$= 8.32$ mg/kg

Where:

$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)

BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 kg/m^3[default]

$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$

$= 0.8 + [(0.2 \times 156.8)/1000 \times 2400]$

$= 76.064\ m^3/m^3$

And:

Kp_{sed} = solid-water partition coefficient (L/kg)

BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 kg/m^3[default]

$Kp_{sed} = K_{oc} \times f_{oc}$

$= 3920 \times 0.04$

$= 156.8$ L/kg

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). For this PNEC calculation, the estimated K_{oc} value of 3,920 L/kg for ethoxylated C12-C16 alcohol based on the MCI method (USEPA, 2019) was used and is consistent with the range of values reported by van Compernolle et al. (2006) in HERA, 2009.
f_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC $_{soil}$

There are no toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 7.32 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
$= (78.4/1500) \times 1000 \times 0.14$
$= 7.32$ mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 kg/m^3 [default]

$Kp_{soil} = K_{oc} \times f_{oc}$
$= 3920 \times 0.02$
$= 78.4\ m^3/m^3$

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). For this PNEC calculation, the estimated K_{oc} value of 3,920 L/kg for ethoxylated C12-C16 alcohol based on the MCI method (USEPA, 2019) was used and is consistent with the range of values reported by van Compernolle et al. (2006) in HERA, 2009.
f_{oc} = fraction of organic carbon in soil = 0.02 [default].

8 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

AE group members are readily biodegradable and thus, do not meet the screening criteria for persistence.

The bioconcentration factors (BCF) in fish for ethoxylated alcohols (which includes AE group members) have been reported to range from <5 to 387.5. Thus, members of this group do not meet the screening criteria for bioaccumulation.

Based on measured acute toxicity endpoints below or equal to 1, AICIS has classified group members ethoxylated C12-C14 alcohol and ethoxylated C12-C15 alcohol as meeting the criteria for toxicity.

Likewise, based on chemical identity and expected composition, ethoxylated C12-C16 alcohol is also categorised by AICIS as toxic. Other group members have not been classified as toxic.

Thus, none of these AE group members are PBT substances.

B. Other Characteristics of Concern

No other characteristics of concern were identified for AE group members.

9 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Alcohols, C6-10, ethoxylated	70879-83-3	Not a PBT	No	No	No	No	No	No	2 (fish), 3 (inv and algae)	2	2
Alcohols, C11-14-iso, C13-rich ethoxylate	78330-21-9	Not a PBT	No	No	No	No	No	No	2 (fish), 3 (inv and algae)	2	2
Alcohols, C12-14, ethoxylated	84133-50-6	Not a PBT	No	No	No	No	No	Yes	2 (fish), 3 (inv and algae)	2	2
Alcohols, C12-15, ethoxylated	68131-39-5	Not a PBT	No	No	No	No	No	Yes	2 (fish), 3 (inv and algae)	2	2
Alcohols, C12-16, ethoxylated	68551-12-2	Not a PBT	No	No	No	No	No	Yes	2 (fish), 3 (inv and algae)	2	2
Poly(oxy-1,2-ethanediyl), .alpha.-dodecyl-.omega.-hydroxy-	9002-92-0	Not a PBT	No	No	No	No	No	No	2 (fish), 3 (inv and algae)	2	2

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework). Acute aquatic toxicity for invertebrates and algae range between 0.14 and 2.84 mg/L with variability likely due to varying test conditions and differences in chemical structure.

3 – Tier 2 – Hazard Assessment and Qualitative Assessment Only. Develop toxicological profile and PNECs for water and soil and provide qualitative discussion of risk.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

10 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
AE	alcohol ethoxylates
ADWG	Australian Drinking Water Guidelines
AICIS	Australian Industrial Chemicals Introduction Scheme
AICS	Australian Inventory of Chemical Substances
ANZG	Australian and New Zealand Guidelines
BCF	bioconcentration factor
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy
ECHA	European Chemicals Agency
EO	ethoxylate
EU	European Union
g/cm^3	grams per cubic centimetre

IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
KI	Klimisch scoring system
KOCWIN™	USEPA organic carbon partition coefficient estimation model
kPa	kilopascal
L/kg	litres per kilogram
MCI	molecular connectivity index
mg/L	milligrams per litre
mPA s	millipascal second
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NOEC	no observed effect concentration
OECD	Organisation for Economic Co-operation and Development
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency
UVCB	Unknown or Variable Composition, Complex Reaction Products and Biological Materials

ALIPHATIC ALCOHOL ETHOXYLATE (CAS RN 9004-77-7)
C8-10 ALKYL ALCOHOL ETHOXYLATE (4EO), PHOSPHATE ESTER (CAS RN 68130-47-2)
ALCOHOL C6-10, ETHOXYLATED (6 EO), SULFATED, MONOISOPROPANOLAMIN SALT (CAS RN 70914-35-1)

This group contains an aliphatic alcohol ethoxylate and group members poly(oxy-1,2-ethanediyl), .α.-hydro-.ω.-hydroxy-, mono-C8-10-alkyl ethers, phosphates (also known as C8-10 alkyl alcohol ethoxylate [4EO], phosphate ester) and alcohol C6-10, ethoxylated (6 EO), sulfated, monoisopropanolamin salt (also known as ethanol, 2-amino-, compounds with polyethylene glycol hydrogen sulfate C6-10-alkyl ether). They are expected to have similar environmental concerns and have consequently been assessed as a group. Information provided in this dossier is based on aliphatic alcohol ethoxylate (CAS RN 9004-77-7). Limited information was available for C8-10 alkyl alcohol ethoxylate (4EO), phosphate ester and ethanol, 2-amino-, compounds with polyethylene glycol hydrogen sulfate C6-10-alkyl ether.

This dossier on aliphatic alcohol ethoxylate and group member C8-10 alkyl alcohol ethoxylate (4EO), phosphate ester and ethanol, 2-amino-, compounds with polyethylene glycol hydrogen sulfate C6-10-alkyl ether presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. It does not represent an exhaustive or critical review of all available data. The information presented in this dossier was obtained primarily from the Human & Environmental Risk Assessment on Ingredients of European Household Cleaning Products: Alcohol Ethoxylates (HERA, 2009), and from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Aliphatic alcohol ethoxylate, C8-10 alkyl alcohol ethoxylate (4EO), phosphate ester and ethanol, 2-amino-, compounds with polyethylene glycol hydrogen sulfate C6-10-alkyl ether are classified as **tier 1** chemicals and require a hazard assessment only.

1 BACKGROUND

Alcohol ethoxylates (AE) are a class of non-ionic surfactants that have the basic structure $C_{x\text{-}y}AE_n$. The subscript (x-y) following the 'C' indicates the range of carbon chain units. The hydrocarbon chain can be either linear or branched. AEs also contain an ethylene oxide chain attached to the alcohol. The degree of ethylene oxide polymerisation is indicated by the subscript (n) which indicates the average number of ethylene oxide (EO) units. Aliphatic alcohol ethoxylate has 0 EO units, C8-10 alkyl alcohol ethoxylate (4EO), phosphate ester has an average number of 4 EO units and ethanol, 2-amino-, compounds with polyethylene glycol hydrogen sulfate C6-10-alkyl ether has 6 EO units.

All of these substances are organic UVCB compounds. Aliphatic alcohol ethoxylate is readily biodegradable, does not bioaccumulate and is of low aquatic and terrestrial toxicity concern.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Poly(oxy-1,2-ethanediyl), α-butyl-ω-hydroxy-

CAS RN: 9004-77-7

Molecular formula: $(C_2H_4O)_nC_4H_{10}O$

Molecular weight: 118.17 g/mol (Substance is a UVCB)

Synonyms: 2-butoxyethanol; butylcellosolve; polyethyleneglycol monobutyl ether; n-butoxyethanol; n-butoxyethanol sodium salt

Chemical Name (IUPAC): Poly(oxy-1,2-ethanediyl), .α.-hydro-.ω.-hydroxy-, mono-C8-10-alkyl ethers, phosphates

CAS RN: 68130-47-2

Molecular formula: Not specified (Substance is a UVCB)

Molecular weight: Not available (Substance is a UVCB)

Synonyms: C8-10 Alkyl alcohol ethoxylate (4EO), phosphate ester; poly(oxy-1,2-ethanediyl), .α.-C8-10-alkyl-.ω.-hydroxy, phosphate

Chemical Name (IUPAC): Ethanol, 2-amino-, compds. with polyethylene glycol hydrogen sulfate C_{6-10}-alkyl ether

CAS RN: 70914-35-1

Molecular formula: $C_2H_7NO.(C_2H_4O)_nH_2O_4S$

Molecular weight: Not available (Substance is a UVCB)

Synonyms: alcohol C6-10, ethoxylated (6 EO), sulfated, monoisopropanolamin salt

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for aliphatic alcohol ethoxylate are shown in Table 1. Physico-chemical property data are not available for C8-10 alkyl alcohol ethoxylate (4EO), phosphate ester and ethanol, 2-amino-, compounds with polyethylene glycol hydrogen sulfate C6-10-alkyl ether.

Table 1 Overview of the Physico-chemical Properties of Aliphatic Alcohol Ethoxylate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	liquid	2	ECHA
Melting Point	-30°C @101.3 kPa	2	ECHA
Boiling Point	278°C @ 101.3 kPa	2	ECHA
Density	985 kg/m^3 @ 20°C	4	ECHA
Vapor Pressure	0.33Pa @ 25°C	2	ECHA-
Partition Coefficient (log K_{ow})	0.44 @ 25°C	1	ECHA
Dissociation Constant (pKa)	14.9 @ 20°C	2	ECHA
Water Solubility	989 g/L @ 20°C	2	ECHA
Viscosity	24.4 mPa s @ 20°C	1	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for either substance.

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Aliphatic alcohol ethoxylate is readily biodegradable and has a low tendency to bind to soil or sediment. It is not expected to bioaccumulate.

B. Partitioning

Aliphatic alcohol ethoxylate is highly soluble in water. Based on the Henry's Law Constant for the monomer of 1.60 X 10^{-6} atm-m^3/mol, it is expected to volatilise from water and moist soil surfaces. It is expected to volatilise slowly from dry soil surfaces based upon its vapour pressure. After evaporation or exposure to air, modelling of 2 -(2 -butoxyethoxy)ethanol (CAS RN 112-34-5), a representative molecule for this UVCB substance, predicts that it is likely to undergo indirect photolysis through hydroxyl radical reaction at a fast rate. The estimated half-life was 2.5 hours (0.21 days) at an OH concentration of 1.5million OH/cm^3 and a 12-hour day (ECHA).

Hydrolysis is not expected to be an important environmental fate process since this compound lacks functional groups that hydrolyse under environmental conditions (PubChem).

C. Biodegradation

In a guideline (OECD 301D) and GLP ready biodegradability study, a substance corresponding to the description "Ethanol, 2-butoxy- manufacture of, by-products from" gave a positive result (>60% degradation relative to the COD value) with a maximum of 76% biodegradation recorded on day 28. In a similar GLP study to the same protocol, the substance "Poly(oxy-1,2-ethanediyl), α-butyl-ω-hydroxy" attained 69% degradation after 28 days [KI Score = 2] (ECHA). Thus, aliphatic alcohol ethoxylate is readily degradable.

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

D. Environmental Distribution

No studies were available for the substance. Based on a log K_{ow} of 0.44, the substance is expected to have a low potential for adsorption and have very high mobility in soil. If released to water, based on its high-water solubility value, it is likely to remain in water and not adsorb to suspended solids or sediment.

E. Bioaccumulation

No studies were available as the substance. Aliphatic alcohol ethoxylate has a low K_{ow} (0.44); and, therefore, bioaccumulation is expected to be low.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Aliphatic alcohol ethoxylate is of low toxicity concern to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on aliphatic alcohol ethoxylate.

Table 3 Acute Aquatic Toxicity Studies on Aliphatic Alcohol Ethoxylate

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Turbot (marine species)	96-hour LC_{50}	>1,800 mg/L	1	ECHA
Daphnia magna	48-hour EC_{50}	>3200 mg/l	1	ECHA
Selenastrum capricornutum	72-hour EC_{50}	2,490 mg/l	2	ECHA

Chronic Studies

No chronic studies were identified for aliphatic alcohol ethoxylate.

In developing a water quality guideline for the alcohol ethoxylates (AE) group (ANZG, 2018), the toxicity data was normalised for a specific alkyl chain length or a specific number of ethoxylate (EO) groups. The NOECs listed below were normalised to an alkyl chain length of C13.3 and EO of 8.2.

Freshwater fish: 2 species, 720 to 1,500 µg/L.

Freshwater crustaceans: 2 species, 590 to 860 µg/L.

Freshwater rotifers: 1 species, *Brachionus calyciflarus*, 1,300 µg/L

Freshwater algae, diatoms and blue-green algae: 6 species, 200 to 8,700 µg/L.

Freshwater mesocosms: 4 NOEC data for multiple species tests were 80, 80, 320 and 330 µg/L, although replication was insufficient to meet OECD (1992) requirements. Normalised data were 380, 380, 320 and 1,520 µg/L.

C. Terrestrial Toxicity

No studies were identified.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Significant biodegradation of aliphatic alcohol ethoxylate is expected. For the purposes of this PBT assessment, the persistence criteria are not met.

Based on a measured log K_{ow} of 0.44, aliphatic alcohol ethoxylate does not meet the screening criteria for bioaccumulation.

The chronic NOEC values for alcohols ethoxylates for fish, invertebrates and algae are >0.1 mg/L. Acute aquatic toxicity data are >1 mg/L. Thus, aliphatic alcohol ethoxylate does not meet the screening criteria for toxicity.

The overall conclusion is that aliphatic alcohol ethoxylate (and C8-10 alkyl alcohol ethoxylate (4EO), phosphate ester and ethanol, 2-amino-, compounds with polyethylene glycol hydrogen sulfate C6-10-alkyl ether by read-across) are not PBT substances.

B. Other Characteristics of Concern

No other characteristics of concern were identified for aliphatic alcohol ethoxylate, C8-10 alkyl alcohol ethoxylate (4EO), phosphate ester or ethanol, 2-amino-, compounds with polyethylene glycol hydrogen sulfate C6-10-alkyl ether.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Aliphatic alcohol ethoxylate	9004-77-7	Not a PBT	No	No	No	No	No	No	1	1	1
Poly(oxy-1,2-ethanediyl), .α.-hydro-.ω.-hydroxy-, mono-C8-10-alkyl ethers, phosphates	68130-47-2	Not a PBT	No	No	No	No	No	No	1	1	1
Ethanol, 2-amino-, compounds with polyethylene glycol hydrogen sulfate C6-10-alkyl ether	70914-35-1	Not a PBT	No	No	No	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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Department of the Environment and Energy [DoEE]. (2017). *Chemical Risk Assessment Guidance Manual: for chemicals associated with coal seam gas extraction*. Guidance manual prepared by Hydrobiology and ToxConsult Pty Ltd for the Department of the Environment and Energy, Commonwealth of Australia, Canberra. https://www.dcceew.gov.au/water/coal-and-coal-seam-gas/national-assessment-chemicals/consultation-risk-assessment-guidance-manual

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Organisation for Economic Co-operation and Development [OECD]. (1992). *Report of the OECD workshop on extrapolation of laboratory aquatic toxicity data to the real environment*. OECD Environment Monographs No. 59, Organisation for Economic Co-operation and Development.

B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy
dw	dry weight
EC	effective concentration

ECHA	European Chemicals Agency
EU	European Union
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kPa	kilopascal
LC	lethal concentration
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
NOEC	no observed effective concentration
PBT	Persistent, Bioaccumulative and Toxic
PEC	Predicted exposure concentrations
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases

D-GLUCOPYRANOSIDE, C9-C11 ALKYL OLIGOMERIC

This dossier on d-glucopyranoside, C9-C11 alkyl oligomeric (also referred to as d-glucopyranose, oligomeric, C9-11-alkyl glycosides) presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. Limited information was available for this non-ionic surfactant. Information provided in this dossier is based on similar read-across substance d-glucopyranose, oligomeric, C10-16-alkyl glycosides (CAS RN 110615-47-9).

This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – d-Glucopyranoside, C9-C11 alkyl oligomeric was assessed as a tier 1 chemical for acute toxicity in algae and as a tier 2 chemical for acute toxicity in fish and invertebrates. d-Glucopyranoside, C9-C11 alkyl oligomeric was assessed as a tier 1 chemical for chronic toxicity in fish, invertebrates and algae. The substance is not readily biodegradable suggesting that chronic lab data would be more relevant than acute results. Therefore, this substance is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

An alkyl polyglycoside (APG) is created by combining glucose and an alcohol. d-Glucopyranose, oligomeric, C9-11-alkyl glycosides is structurally-related to d-glucopyranose, oligomeric, C10-16-alkyl glycosides. These chemicals differ from one another only in the length of the alkyl chain. Given these structural similarities, these chemicals have similar toxicological characteristics.

d-Glucopyranose, oligomeric, C10-16-alkyl glycosides is readily biodegradable and has a low potential for bioaccumulation. It is not expected to strongly adsorb to soil or sediment. d-Glucopyranose, oligomeric, C10-16-alkyl glycosides is of low concern to aquatic and terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): D-Glucopyranose, oligomeric, C9-11-alkyl glycosides

CAS RN: 132778-08-6

Molecular formula: Unspecified, substance is a UVCB

Molecular weight: Unspecified, substance is a UVCB

Synonyms: d-glucopyranoside, C9-C11-alkyl oligomeric; d-glucopyranose, oligomeric, C9-11 alkyl glycosides;

Chemical Name (IUPAC): D-Glucopyranose, oligomeric, C10-16(even numbered) alkyl glycosides

CAS RN: 110615-47-9

Molecular formula: Unspecified, substance is a UVCB

Molecular weight: Unspecified, substance is a UVCB

Synonyms: d-glucopyranose, oligomeric, C10-16-alkyl glycosides; d-glucopyranoside, oligomeric, alkyl (C10-16) glycosides

3 PHYSICO-CHEMICAL PROPERTIES

Limited data was available for d-glucopyranoside, C9-C11-alkyl oligomeric. Key physical and chemical properties for read-across d-glucopyranose, oligomeric, C10-16-alkyl glycosides are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of d-glucopyranoside, C9-C11-alkyl oligomeric [1]

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Solid	1	ECHA
Melting Point	<150°C @ 101.3 kPa	1	ECHA
Boiling Point	>301 °C @ 101.3 kPa	1	ECHA
Density	1161 kg/m^3 @ 20°C	1	ECHA
Vapor Pressure	<0.0077 Pa @ 20°C	2	ECHA
Partition Coefficient (log K_{ow})	<-0.07 @ 20°C	2	ECHA
Dissociation Constant (pKa)	Not feasible	-	ECHA
Water Solubility	>200 g/L @ 20°C	1	ECHA
Viscosity	Not applicable, substance is a solid	-	ECHA

[1] - Chemical-specific data is not available for d-glucopyranoside, C9-C11-alkyl oligomeric. Data is shown for read-across chemical d-glucopyranose, oligomeric, C10-16-alkyl glycosides (CAS RN 110615-47-9).

The Alkyl Polyglycosides Category contains D-Glucopyranose monomers and oligomers with fatty alcohols C4 to C18 linear and C9 to C11 (mono-)branched and linear. Structural similarities of the category substances are reflected in similar physico-chemical properties and mode of action. Alkyl polyglycosides have a common metabolic fate that involves hydrolysis of the α- and β-glycosidic bond to the fatty alcohol and glucose. Glucose and glucose oligomers enter the carbohydrate metabolic pathway and are catabolised into pyruvate and subsequently to the major extent into acetyl-CoA, which is introduced into the citric acid cycle with the aim to generate reduction equivalents for energy generation in the oxidative phosphorylation. Fatty alcohols, representing the main difference in the structure of different alkyl polyglycosides, are oxidized to the corresponding fatty acid and fed into the physiological pathway of β-oxidation, where they are also oxidised to acetyl-CoA. In addition to its function in the generation of energy by catabolic processes acetyl-CoA can also be used in anabolic processes like lipid synthesis which is important for the storage of energy in form of large high-energy macromolecules (ECHA).

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS

(Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for d-glucopyranoside, C9-C11-alkyl oligomeric.

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Chemical-specific data is not available for d-glucopyranoside, C9-C11-alkyl oligomeric. Data is shown for read-across substance d-glucopyranose, oligomeric, C10-16-alkyl glycosides (CAS RN 110615-47-9).

d-Glucopyranose, oligomeric, C10-16-alkyl glycosides is readily biodegradable and has a low potential for bioaccumulation. It is not expected to strongly adsorb to soil or sediment.

B. Partitioning

d-Glucopyranose, oligomeric, C10-16-alkyl glycosides is highly soluble in water. Volatilization from water or moist soil surfaces is not expected to be an important fate process based upon its water solubility. It is not expected to volatilize from dry soil surfaces based upon its estimated vapour pressure.

d-Glucopyranose, oligomeric, C10-16-alkyl glycosides is hydrolytically stable at pH 4, 7 and 9 (ECHA) [Kl. Score = 1].

C. Biodegradation

d-Glucopyranose, oligomeric, C10-16-alkyl glycosides is readily biodegradable. In an OECD Guideline 301 D (Ready Biodegradability: Closed Bottle Test), the substance was degraded to 86% after 28 days (ECHA) [Kl. Score = 2].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

D. Environmental Distribution

In an OECD Guideline 121 (Estimation of the Adsorption Coefficient (Koc) on Soil and on Sewage Sludge using High Performance Liquid Chromatography (HPLC)), the log K_{oc} of d-glucopyranose, oligomeric, C10-16-alkyl glycosides was estimated to be 1.7 (K_{oc} of 50.12 L/Kg) at 25 °C (ECHA). [Kl. Score = 1]

Based on this K_{oc} value, if released to soil, d-glucopyranose, oligomeric, C10-16-alkyl glycosides is not expected to strongly adsorb to soil and be mobile. If released to water, based on the K_{oc} value and its high water solubility, it is expected to preferentially partition to the water column.

E. Bioaccumulation

There are no bioaccumulation studies on d-glucopyranose, oligomeric, C10-16-alkyl glycosides. Based on the log K_{ow} (-0.07), bioaccumulation is not to be expected (ECHA).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Chemical-specific data is not available for d-glucopyranoside, C9-C11-alkyl oligomeric. Data is shown for read-across substance d-glucopyranose, oligomeric, C10-16-alkyl glycosides (CAS RN 110615-47-9).

d-Glucopyranose, oligomeric, C10-16-alkyl glycosides is of low concern to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies on d-glucopyranose, oligomeric, C10-16-alkyl glycosides.

Table 3 Acute Aquatic Toxicity Studies on d-Glucopyranose, oligomeric, C10-16-alkyl glycosides

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Danio rerio	96-hour LC_{50}	5.9	2	ECHA
Daphnia magna	48-hour LC_{50}	7	2	ECHA
Desmodesmus subspicatus	72-hour EC_{50}	12.5 (growth rate)	2	ECHA

Chronic Studies

A 28-day NOEC value of 1.8 mg/L was determined for Zebrafish (ECHA) [Kl. score = 1].

A 21-day NOEC value of 2 mg/L was determined for Daphnia magna (ECHA). [Kl. Score=2]

No chronic data was available in freshwater algae. In marine algae (*Skeletonema costatum*), the 72-hour NOEC was 1.8 mg/L, based on growth rate (ECHA) [KI. Score = 2].

C. Terrestrial Toxicity

In a 14-day long-term toxicity study with Eisenia fetida (worms), the lethal concentration (LC_0) was estimated to be >654 mg/kg soil dw (ECHA) [Kl. Score = 2].

In a 14-day OECD Guideline 208 study with terrestrial plants [oat (Avena sativa), turnip (Brassica rapa) and tomato (Lycopersicon esculentum)], a NOEC of 654 mg/kg soil dw was determined (ECHA) [Kl. Score = 2].

Considering that the chemical is readily biodegradable in soil, toxicity to terrestrial organisms is expected to be low (ECHA).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (DEWHA, 2022; ECHA, 2023).

Based on read-across, d-glucopyranoside, C9-C11-alkyl oligomeric is readily biodegradable; thus, it does not meet the screening criteria for persistence.

No data are available on bioaccumulation. However, based on the low log K_{ow}, bioaccumulation is not expected. Thus, d-glucopyranoside, C9-C11-alkyl oligomeric does not meet the screening criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on read-across for d-glucopyranoside, C9-C11-alkyl oligomeric are >0.1 mg/L. The EC_{50} values for read-across d-glucopyranoside, C9-C11-alkyl oligomeric are > 1 mg/L. Thus, d-glucopyranoside, C9-C11-alkyl oligomeric does not meet the criteria for toxicity.

Therefore, d-glucopyranoside, C9-C11-alkyl oligomeric is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for d-glucopyranoside, C9-C11-alkyl oligomeric.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
d-Glucopyranoside, C9-C11-alkyl oligomeric	132778-08-6	Not a PBT	No	No	No	No	No	No	2 (fish & inv); 1 (algae)	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework). Tier 1 assigned based on chronic data from more toxic read-across. Toxicity for d-Glucopyranoside, C9-C11-alkyl oligomeric is expected to be even lower.

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

Department of the Environment and Energy [DoEE]. (2017). *Chemical Risk Assessment Guidance Manual: for chemicals associated with coal seam gas extraction*. Guidance manual prepared by Hydrobiology and ToxConsult Pty Ltd for the Department of the Environment and Energy, Commonwealth of Australia, Canberra. https://www.dcceew.gov.au/water/coal-and-coal-seam-gas/national-assessment-chemicals/consultation-risk-assessment-guidance-manual

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
g/mL	grams per millilitre
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg/m^3	kilogram per cubic metre
KI	Klimisch scoring system
kPa	kilopascal
LC	lethal concentration
mg/kg dw	milligrams per kilogram dry weight
mg/L	milligrams per litre

NOEC	no observed effective concentration
OECD	Organisation for Economic Co-operation and Development
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

ALUMINIUM

This dossier on aluminium presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed aluminium in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to human health and the environment.[1][2]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): Aluminium

CAS RN: 7429-90-5

Molecular formula: Al

Molecular weight: 26.982 g/mol

Synonyms: Aluminium flake; Allbri aluminum paste and powder

SMILES: [Al]

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of aluminium

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Solid silver white metal	2	ECHA
Melting Point	660°C @ 101.3 kPa	2	ECHA
Boiling Point	2450°C @ 101.3 kPa	2	ECHA
Density	2700 kg/m^3 @ 25°C	2	ECHA
Vapour Pressure	133 Pa @ 1284°C	2	ECHA
Partition Coefficient (log K_{ow})	Not applicable. The substance is inorganic	-	ECHA
Water Solubility	0 g/L @ 20°C Insoluble in water	2	ECHA

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=b763433e-f36b-1410-8de4-00e8f2afc108
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=1375433e-f36b-1410-8de4-00e8f2afc108

Property	Value	Klimisch Score	Reference
Flash Point	Not applicable. The substance is a solid.	-	ECHA
Auto flammability	No self-ignition was observed.	2	ECHA
Viscosity	Not applicable. The substance is a solid.	-	ECHA
Henry's Law Constant	Not Available	-	-

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Aluminium is inorganic and does not undergo biodegradation. It is not expected to bioaccumulate. The potential of aluminium for adsorption to sediment and soil particles is based on its speciation, which varies by pH, and the concentration of dissolved organic carbon (DOC).

B. Biodegradation

Biodegradation testing is not relevant for aluminium as it is inorganic in nature (ECHA).

C. Environmental Distribution

The potential of aluminium for adsorption to sediment and soil particles is based on its speciation, which varies by pH, and the concentration of dissolved organic carbon.

Aluminium can participate in hydrolysis reactions, which are pH-dependent. In the absence of organic matter, aluminium cation (3+) is the predominant aluminium species at low pH (less than 5.5). As pH increases above 5.5, aluminium-hydroxide complexes formed by hydrolysis become increasingly important and dominate aqueous aluminium speciation. The presence of a moderate amount of organic matter in soft water results in organically complexed aluminium being the dominant aluminium form when the pH is between 4 and 7. Above pH 7, anionic aluminium hydroxide predominates (ECHA).

For evaluation of adsorption at different pH levels, a chemical simulation was performed. In the stimulation, the amount of aluminium bound to particles as a result of surface complexation (i.e., adsorption) was pH dependent but was typically less than 8% of the total aluminium at pH 6 and was further reduced to below 1% at pH values above 7. This distribution was similar in both soft and hard waters. The corresponding Log K_d values for this distribution are between 3 and 5. Similar results were obtained with higher DOC concentrations of 4 mg/L (ECHA) [Kl.score=2].

D. Bioaccumulation

Fish accumulate aluminium in and on the gill, and it has been suggested that the rate of transfer of aluminium into the body is either slow or negligible under natural environmental conditions (Spry and Wiener, 1991). The initial uptake of aluminium by fish occurs mainly on the gill mucous layer (Wilkinson and Campbell, 1993); both mucus and bound aluminium may be rapidly eliminated following exposure. Roy (1999) calculated the BCFs in fish to range from 400 to 1,365 L/kg.

The BCF for *Daphnia magna* varied from 10,000 L/kg at pH 6.5 to 0 at pH 4.5, based on the results of Havas (1985). Most of the metal appears to be adsorbed to external surfaces and is not internalised (Havas, 1985; Frick and Hermann, 1990).

The accumulation of aluminium by the algae *Chlorella pyrenoidosa* increased with the concentration of inorganic monomeric aluminium (Parent and Campbell, 1994). A comparison of assays performed at different pH values, but the same concentration of aluminium showed suppression of that aluminium accumulation at low pH.

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Following absorption by any route of exposure, aluminium is present in the body as the ionic species (Al_3^+) which is consequently the determining driver regarding the systemic effects of aluminium salts. Aluminium has low acute toxicity by the oral and inhalation routes. It is corrosive to the skin and mucous membranes. However, it is not a skin sensitiser. Systemic effects associated with neurotoxicity have been identified from repeated dose toxicity studies. Aluminium is not genotoxic nor carcinogenic.

B. Toxicokinetics

Adsorption

Following absorption by any route of exposure, aluminium is present in the body as the ionic species (Al_3^+) (ECHA).

Aluminium is poorly absorbed following oral exposure. Approximately 0.1–0.6 % of ingested aluminium is usually absorbed, depending on the dose. The observed relationship between dose and bioavailability is inconsistent: increased doses of aluminium decreased its bioavailability in some experimental studies while opposite results were observed in other work (NICNAS, 2015).

In a human dermal absorption study, 6 female subjects were exposed to 1.5 g of an antiperspirant formulation containing 25% of aluminium hydroxychloride with radiolabelled aluminium Al. On each axilla, an amount of 0.75 g of antiperspirant was applied under protective gauze. Measurements (blood, urine, faeces, tape stripping and skin biopsies) were collected in the first 24 hours and the following ten days. At the end the treatment, the subjects were given an intravenous (IV) dose of 1 µg/mL radiolabelled aluminium. Radioactivity in blood and urine was monitored for 24 hours. The majority (more than 95%) of the applied topical dose was found on clothing, experimental equipment or washed off the skin (SCCS 2020 cited in AICIS, 2022). [Kl. score = 2]

In another cohort, 6 female subjects were exposed to the same dermal exposure protocol as above. Within the first 24 hours, tape stripping was performed at 4 different sites on the axilla, at 20 min, 1 h, 4 h and 24 h post application. Skin punch biopsy was performed 24 h post application. The overall recovery of the applied dose was 69% (mostly in skin wash). Aluminium in the bloodstream was below detection limits. A total of 0.0003% and 0.0014% of the applied dose were recovered in the urine and faeces, respectively. A total of 70% of the IV dose was excreted in urine. Based on these results, a dermal absorption value of 0.00052% was calculated. Combined with the Al found in the faeces in the same study (0.0014%), the overall percentage of bioavailable Al is 0.00192%. (SCCS 2020 cited in AICIS, 2022). [Kl. score = 2]

Excretion

Following oral exposure, unabsorbed aluminium is excreted in the faeces. Absorbed aluminium is excreted principally in the urine and, to a lesser extent, in the bile. It was reported that the higher

urinary excretion of aluminium in exposed workers, compared to the general population, demonstrates that some inhaled aluminium can reach the systemic circulation (NICNAS, 2015).

Distribution

Aluminium binds to various ligands in the blood and distributes to every organ, with highest concentrations found in bone and lung tissues. It crosses the brain and placental barriers in very small amounts. Human and animal studies demonstrate accumulation of aluminium in the brain and, in animal studies, in foetuses (ATSDR, 2008 cited in NICNAS, 2015).

Aluminium is efficiently transferred from blood to milk in lactating animals and there is evidence that with increasing age of humans, aluminium concentrations increase in the brain tissue, blood and bone (NICNAS, 2015).

C. Acute Toxicity

In accordance with OECD 401, the oral LD_{50} of read-across substance aluminium oxide in rats is >2,000 mg/kg (ECHA). [Kl. score = 2]

In accordance with OECD 403, the inhalation 4-hour LC_{50} of read-across substance aluminium flake dust in rats is >880 mg/m^3 as aerosol (ECHA). [Kl. score = 1]

D. Irritation

Skin

In read-across studies, aluminium is not considered irritating to the skin.

In an OECD Guideline 404 (Acute Dermal Irritation / Corrosion), the dermal irritation effects of aluminium oxide in New Zealand White albino rabbits were studied. Slight erythema was observed on the intact skin of 2 animals (one 24 hours after the substance application and the other 72 hours after application). No signs of skin irritation were observed on the abraded skin at any time. The overall primary irritation score from the study (0.2) would not lead to classification (ECHA). [Kl. Score =2]

In another OECD Guideline 404 (Acute Dermal Irritation / Corrosion) study aluminium hydroxide in New Zealand White albino rabbits was studied. There was no mortality or systemic clinical changes related to Aluminium Hydroxide administration. There was no effect of treatment on body weight. At observation one hour after patch removal, very slight erythema (score 1) was observed in two animals. At 24, 48 and 72 hours after patch removal, there were no observed clinical signs noted on the skin of the treated animals. As no clinical signs were observed up to 72 hours after patch removal, the study was terminated after the 72-hour observation. The animals' individual means scores (considering readings at 24, 48 and 72 hours after patch removal) for erythema and oedema were 0.00, 0.00 and 0.00 respectively (ECHA). [Kl. Score =2]

Eye

In an eye irritation study of aluminium oxide performed in White albino rabbits, no eye irritation/ corrosion effects were observed. Six animals were used in this experiment. The test item was placed into the conjunctival sac of the eye. The untreated eye served as control. The eyes of the test animals were not washed after the application of the test item. The eyes were examined 24, 48, 72

hours and 7 days after the application. No examination was conducted 1 hour after the application. Initial Pain Reaction was not reported. At 24 hours after instillation a conjunctival redness (score 1) and chemosis (score 1) was observed in all animals. No cornea or iris lesions in any animal. At 48 hours after instillation, conjunctival redness (score 1) was observed in all animals and chemosis (score 1) in 4 animals. No animals showed signs of cornea or iris lesions. At 72 hours after instillation, conjunctival redness (score 1) was observed in all animals. No animal showed signs of chemosis, cornea or iris lesions. At 7 days after instillation, conjunctival redness (score 1) was observed in one animal, and there were no signs of chemosis, cornea or iris lesions in any animal. (ECHA) [Kl. score=2].

E. Sensitisation

Read-across substance aluminium hydroxide was not a skin sensitiser in a guinea pig maximisation test using the Magnusson and Kligman method (OECD 406 (Skin Sensitisation Test). In the study, guinea pigs were treated with aluminium hydroxide. None of the treated animals showed a positive skin reaction after 24 and 48 hours. No reactions were observed in the control group. The results indicate a sensitisation rate of 0% (0/10), which is below the threshold of 30%. Therefore, aluminium hydroxide was not a sensitising substance (ECHA). [Kl. score = 1]

F. Repeated Dose Toxicity

Oral

In a developmental neurotoxicity and chronic toxicity study similar to OECD guidelines 426 and 452, male and female Sprague-Dawley rats were administered aqueous solutions of aluminium citrate at 3 dosage levels of aluminium citrate 3225 mg/Al citrate/ kg bw/day (300 mg Al/kg bw/day); 1075 mg/Al citrate/kg bw/day (100 mg Al/kg bw/day); 322.5 mg/Al citrate/kg bw/day (30 mg Al/kg bw/day). This study was designed “to develop data on the potential functional and morphological hazards to the nervous system that may arise from pre-and post-natal exposure to aluminium citrate”. The Al citrate and Na-citrate were administered to dams *ad libitum* via drinking water from gestation day 6 until weaning of offspring. Litter sizes were normalized (4 males and 4 females) at postnatal day (PND) 4. Weaned offspring were dosed at the same levels as their dams. Pups were assigned to one of four cohorts (80 males, 80 females): a pre-weaning cohort that was sacrificed at PND 23, and cohorts that were sacrificed at PND 64, PND120 and PND 364.

The results from this study are informative for neurotoxic effects due to combined prenatal and chronic postnatal exposure of rats to high doses of aluminium (30 mg Al/kg bw/day, 100 mg Al/kg bw/day and 300 mg Al/kg bw/day). As the offspring were dosed during the whole post-weaning period, it is difficult to differentiate between developmental or direct toxicity after weaning, however. Urinary tract pathology was observed in rats in the high dose group, more frequently and more severe in the males. The study showed no evidence of an effect of Al-citrate on memory or learning but a more consistent effect was observed in endpoints in the neuromuscular domain. A NOAEL of 322.5 mg/kg bw/day aluminium citrate was established (equivalent to 30 mg Al/kg bw/day) at the highest dose tested (ECHA). [Kl. score = 1]

One long-term chronic oral toxicity study investigated neurodegeneration in aged rats at aluminium levels relevant to total human intake. Thirty Wistar rats (10 per dose) were orally exposed to 0.4 mg, 0.5 mg and 1.7 mg Al/kg bw/day in their food (0.4 mg Al/kg bw/day for all groups) and water (as 0, 2 and 20 ppm Al, equivalent to 0, 0.9 and 11.6 mg AlCl3.6H2O/kg bw/day). Dosing for the rats commenced from 12 months old (equivalent to 35-year-old humans) until the end of their natural life (28 to 37.5 months, equivalent to 82-109 year old humans) and cognitive function was evaluated using the T-maze task. By age 28 months, none of the rats (0/10) in the low Al dose group, two of the

rats (2/10) receiving the intermediate Al dose and seven rats (7/10) that consumed Al at the high end of the human range for total dietary Al exhibited significantly lower mean scores on their T-maze task in old age than in middle age, as well as showing dementia-like behaviours such as confusion, inability to focus attention on the task, perseverative activities and incontinence in the T-maze. This study established a no observed effect level (NOEL) of 0.4 mg Al/kg bw/day and LOAEL of 0.5 mg Al/kg bw/day in rats (equivalent to 0 and 0.9 mg AlCl3.6H2O) based on significant cognitive deterioration and neuropathology (brain lesions) (NICNAS, 2015).

In humans, patients with renal failure are at risk of neurotoxicity from aluminium (EHC, 1997 cited in NICNAS, 2014). There is also some epidemiological evidence for long-term cognitive impairment in pre-term infants receiving aluminium-containing nutritional solution intravenously, and associated with occupational exposures (ATSDR, 2008 cited in NICNAS, 2015).

Epidemiological studies have addressed the potential neurotoxicity of aluminium in drinking-water or antacids with mixed results. Some of the drinking-water studies showed an association of aluminium with dementia or Alzheimer's disease, whereas others reported an absence of neuropsychological effects measured in several ways (IPCS, 2012 cited in NICNAS, 2015). Nine out of 13 published epidemiological studies of aluminium in drinking water and Alzheimer's disease have shown statistically significant positive relations (Flatten, 2001 cited in NICNAS, 2015).

Inhalation

In an OECD Guideline 452 (Chronic Toxicity Studies), rats, guinea pigs and hamsters were exposed to three different aluminium powders (British pyro powder, a US-flake powder, and a US-source atomized powder with approximately spherical particles) and also aluminium oxide dust, included as a negative “non-fibrogenic control”. The Al2O3 content was 16.6% for the British pyro powder, not stated for the flake powder and 2.9% for the atomized powder. The doses administered by inhalation ranged from 15 to 100 mg/m³, 6 hours per day, 5 days per week for either 6 or 12 months. Thirty rats were exposed to pyro powder at each 15, 30, 50 and 100 mg/m³, 30 rats were exposed to atomized metal powder at each 15, 30, 50 and 100 mg/m³, 30 rats were exposed to flake powder at 15 and 30 mg/m³, and 30 rats were exposed to aluminium oxide dust at 30 and 75 mg/m³.

Intratracheal injection of aluminium powder caused nodular pulmonary fibrosis in the lungs of the rats only at the highest dose administered (100 mg). A fibrotic response was not observed in hamsters indicating inter-species differences in response. 12 mg of dust administered intratracheally did not lead to collagen production in rats or hamsters. The response of hamster and guinea pigs lungs differed from rats. At higher concentrations, hamster and guinea pig lungs developed metaplastic foci of alveolar epithelium that persisted beyond the resolution of alveolar proteinosis and clearance of the dust particles. There was no dose response evident or a noticeable difference between responses to the different aluminium powders.

Progressive fibrosis was not observed in rats on inhalation exposure to the powders indicating that the intratracheal instillation mode of test compound delivery may lead to artifacts not representative of actual inhalation exposures. All three species developed widespread alveolar proteinosis, rats exhibiting the most severe response. The proteinosis resolved progressively after cessation of exposure. The group of rats exposed for 12 months to 15 mg/m³ of aluminium powder showed moderate alveolar proteinosis after only 6 months of exposure. A NOAEC of 75 gm/m3 was established based on the highest dose tested (ECHA). [Kl. score = 2]

Dermal

No adequate studies are available.

G. Genotoxicity

There are no indications for a genotoxic potential of aluminium based on *in vitro* and *in vivo* studies on read-across substances.

In Vitro Studies

Representative *in vitro* genotoxicity studies on read-across substances for aluminium are presented in Table 3.

Table 3 *In Vitro* Genotoxicity Studies on Aluminium Hydroxychloride

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial reverse mutation (*S. typhimurium* and *E. coli* strains)	-	-	1	ECHA
Mammalian cell gene mutation (mouse lymphoma L5178Y cells)	-	-	1	ECHA
Micronucleus (peripheral human lymphocytes)	-	-	1	ECHA

*+, positive; -, negative

In Vivo Studies

Read-across substance aluminium hydroxide was tested in an OECD Guideline 474 (Mammalian Erythrocyte Micronucleus Test). In the study, aluminium hydroxide did not induce micronuclei in the polychromatic erythrocytes of the bone marrow of male rats treated up to 2000 mg/kg/day (corresponding to 700 mg Al/kg bw/day) (ECHA). [Kl. score = 1]

In an OECD Guideline 475 (Mammalian Bone Marrow Chromosome Aberration Test), single doses of aluminium oxide particulate suspensions were administered to rats by oral gavage. The study results were positive for the nano-sized materials with evidence of a dose-response relationship, while the genotoxicity levels for aluminium oxide bulk material (50 to 200 µm diameter particles) were not statistically significantly different from those for the control. The relevance of the results with nanomaterials for hazard assessment is unclear as the observed effects may have been related to the presence of nanoparticles as foreign bodies in the cells rather than to the chemical properties of the test material itself. Low toxicity, poorly soluble substances, such as aluminium oxide, have produced inflammatory effects *in vitro*, when present as nanoparticles. A particle size dependence of gastrointestinal absorption was apparent. Aluminium oxide levels in the tissues of animals dosed with the larger 50 to 200 µm diameter particles were not elevated to a statistically significant level, consistent with the notion of a low bioavailability of aluminium compounds (ECHA). [Kl. score = 2]

H. Carcinogenicity

Systemic carcinogenic effects from exposure specifically to aluminium have not been investigated in epidemiological studies. One study (Friesen et al., 2009 cited in ECHA) that investigated associations between aluminium dust exposure and cancer incidence did not find evidence of an increase in risk of any cancer. The study was based on relatively few cases observed during a short follow-up period, and only crude adjustment for smoking was done. However, the evidence from epidemiological studies does not support a carcinogenic effect of aluminium.

A few publications postulated that the use of aluminium-containing antiperspirants may be associated with an increasing incidence of breast cancer (Darbre, 2016 in ECHA), but evidence is inconclusive that aluminium is a causative agent for cancer development. While Linhart et al., 2017 (cited in ECHA) identified that use of underarm cosmetic products (UCP) was significantly associated with risk of breast cancer ($p = 0.036$) in women who reported using underarm cosmetic products several times daily starting at an age earlier than 30 years, aluminium in breast tissue was found in both cases and controls. At the same time, the total amount of toxic heavy metals, such as iron, nickel, chromium, and lead, are also significantly elevated in breast cancer tissue (ECHA).

I. Reproductive/Developmental Toxicity

In an OECD Guideline 422 (Combined Repeated Dose Toxicity Study with the Reproduction / Developmental Toxicity Screening Test), male and female Wistar rats were dosed by oral gavage with 0, 40, 200, or 1,000 mg/kg aluminium hydroxychloride; these doses correspond to 0, 3.6, 18 or 90 mg/kg-day aluminium. No adverse effects on reproductive behaviour, mating criteria and histological structure of examined reproductive organs during pre-mating, gestation and short-time lactation period were reported. The NOAEL for reproductive toxicity (lack of reproductive /breeding, mating impairment and early postnatal developmental effects) was considered to be 1000 mg aluminum chloride basic/kg bw/day (90 mg Al/kg bw/day). Inflammation of the glandular stomach mucosa was observed at 90 mg Al/kg bw/day (LOAEL local), but not at 18 mg Al/kg bw/day (NOAEL local) or below (ECHA). [Kl. Score = 1]

In an OECD Guideline 416 (Two-Generation Reproduction Toxicity Study), the potential reproductive toxicity of aluminium ammonium sulphate (CAS#: 7784-25-0 (anhydrous)) CAS#: 7784-26-1 (dodecahydrate)] was investigated in Crl:CD (SD) rats. Aluminium ammonium sulphate (AAS) was dissolved in deionized water at 0, 50, 500 or 5000 mg/L. The Al concentration in the deionized water was < 5 µg/mL and the Al content of the diet was 22-29 mg/kg Groups of 24 male and 24 female Crl:CD (SD) rats (F0 generation) were given AAS in drinking water from 5 weeks of age for 10 weeks prior to mating, during mating and gestation, when the parental males were culled, and for the females through weaning. Litters were normalized to 8 pups on PND 4. At weaning, 24 males and 24 females were selected to serve as the F1 generation and they were given AAS in drinking water for 10 weeks prior to mating, during mating and gestation, and for the females through weaning, as for the F0 generation. Exposure of the F1 weanlings occurred at the same concentrations as those of their parents.

The major findings reported by the authors were decreased body weight in preweaning animals, delayed maturation of the female offspring, and decreased organ weight in the offspring. The authors identified a LOAEL of 5000 mg AAS/L for both parental toxicity and reproductive toxicity (based on reduced preweaning body weight gain in F1 male (at PND 21) and female (PND 14, 21) pups, delay in the vaginal opening in F1 female pups, potentially attributed to inhibition of growth and decreased organ weights in F1 and F2 male and female offspring). The suggested LOAEL level

corresponds to 36.3 mg Al/kg bw per day. The reported NOAEL is 500 mg AAS/L which corresponds to 5.35 mg Al/kg bw per day (ECHA). [Kl. score = 2]

In a developmental neurotoxicity and chronic toxicity study similar to OECD guidelines 426 and 452, male and female Sprague-Dawley rats were administered aqueous solutions of aluminium citrate at 3 dosage levels of aluminium citrate 3225 mg/Al citrate/ kg bw/day (300 mg Al/kg bw/day); 1075 mg/Al citrate/kg bw/day (100 mg Al/kg bw/day); 322.5 mg/Al citrate/kg bw/day (30 mg Al/kg bw/day). This study was designed "to develop data on the potential functional and morphological hazards to the nervous system that may arise from pre-and post-natal exposure to aluminium citrate". The Al citrate and Na-citrate were administered to dams *ad libitum* via drinking water from gestation day 6 until weaning of offspring. Litter sizes were normalized (4 males and 4 females) at postnatal day (PND) 4. Weaned offspring were dosed at the same levels as their dams. Pups were assigned to one of four cohorts (80 males, 80 females): a pre-weaning cohort that was sacrificed at PND 23, and cohorts that were sacrificed at PND 64, PND120 and PND 364.

The results from this study are informative for neurotoxic effects due to combined prenatal and chronic postnatal exposure of rats to high doses of aluminium (30 mg Al/kg bw/day, 100 mg Al/kg bw/day and 300 mg Al/kg bw/day). As the offspring were dosed during the whole post-weaning period, it is difficult to differentiate between developmental or direct toxicity after weaning, however. Urinary tract pathology was observed in rats in the high dose group, more frequently and more severe in the males. The study showed no evidence of an effect of Al-citrate on memory or learning but a more consistent effect was observed in endpoints in the neuromuscular domain. The NOAEL for neurotoxicity was 322.5 mg/kg bw/day of aluminum citrate (equivalent to 30 mg Al/kg bw/day). Furthermore, based on the lack systemic effects in general and of effects on gestational length in particular and the absence of clinical signs in maternal animals, 3225 mg/kg bw/day of aluminum citrate (equivalent to 300 mg Al/kg bw/day) was considered the maternal NOAEL for reproduction toxicity (ECHA). [Kl. Score = 1]

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for aluminium stearate follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

TRVs were not derived for aluminium. The Australian drinking water guideline values (ADWG) for aluminium may be applicable (ADWG, 2011).

ADWG has concluded that there is insufficient data to set a guidance value for aluminium based on health considerations. Based on aesthetic problems caused by post-flocculation, the concentration of acid-soluble aluminium in drinking water should not exceed 0.2 mg/L. Water authorities are strongly encouraged to keep acid-soluble aluminium concentrations as low as possible, preferably below 0.1 mg/L (ADWG, 2011).

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Aluminium powder may be flammable. Aluminium does not exhibit the following physico-chemical properties:

- Explosivity
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Factors that influence aluminium toxicity are consistent with the factors that influence aluminium speciation. These factors include pH, DOC, and water hardness. Aluminium ions released to surface waters quickly form insoluble aluminium hydroxides in mixing zones. These colloids can sorb to fish gills resulting in asphyxiation and mortality in rare circumstances. Formation of the complex hydroxide causes the aluminium to drop out of solution very rapidly in neutral and alkaline waters. The accumulation of aluminium on fish gills or other organism respiratory membranes may result in physical effects. These conditions however are not typical of most ambient conditions and are more representative of specific mixing zones. The dissolved natural background concentrations of aluminium, in most cases, are at equilibrium therefore an addition of aluminium would lead to the precipitation of aluminium compounds from solution and not result in effects to aquatic life (ECHA).

Aluminium is expected to have low toxicity to terrestrial organisms.

B. Aquatic Toxicity

Table 3 lists the results of acute aquatic toxicity studies conducted on aluminium.

The pH significantly alters the speciation and therefore bioavailability of the aluminium such that acutely toxic concentrations occur below a pH of 6 but that above 6 the bioavailable concentration necessary to achieve immobilisation in an acute study cannot be achieved (ECHA).

Table 3: Acute Aquatic Toxicity Studies on Aluminium

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Ictalurus punctatus, Lepomis cyanellus, Oncorhynchus mykiss, Perca flavescens, Pimephales promelas, Salmo salar, and Salmo trutta (Fish)	96-hr LC_{50}	0.1 – >200	-	ECHA
Dapnia magna and Ceriodaphnia dubia (Water flea)	48-hr EC/LC_{50}	0.071 – >99.6	-	ECHA
Raphidocelis subcapitata (Green algae)	ECr_{10}	0.024 – 4.93	-	ECHA

In developing a water quality guideline for aluminium (ANZG, 2018), ANZG[3] separated the screened freshwater toxicity data into those conducted at pH >6.5 and those at pH <6.5. These data are summarised below (it should be noted that only the acute toxicity data was used to derive a water quality guideline).

[3] ANZECC water quality guidelines were revised in 2018 and are now referred to as Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG)

Freshwater pH >6.5

- Fish: The 48-96 hour LC_{50} values for 5 species were 600 to 106,000 µg/L (the lowest value was for *Salmo salar*). The chronic 8- to 28-day NOEC equivalents[4] from seven species were 34-7,100 µg/L. The lowest measured chronic value was an 8-day LC_{50} for *Micropterus* species of 170 µg/L.
- Amphibian: The 96-hour LC_{50} values for *Bufo americanus* were 860-1,660 µg/L. The chronic 8-day LC_{50} for *Bufo americanus* was 2,280 µg/L.
- Crustacean: The 48-hour LC_{50} values for one species were 2,300-36,900 µg/L. The chronic 7- to 28-day NOECs were 136-1,720 µg/L.
- Algae: The 96-hour EC_{50} values were 460-570 µg/L based on population growth. The NOECs for two species were 800-2,000 µg/L.

Freshwater pH<6.5 (all between pH 4.5 and 6.0)

- Fish: The 24-96-hour LC_{50} values for two species were 15-4,200 µg/L (the lowest value was for *Salmo trutta*). The 21- to 42-day LC_{50} values were 15-105 µg/L.
- Amphibian: The 96- to 120-day LC_{50} values were 540-2,670 µg/L; the absolute range was 400-5,200 µg/L.
- Algae: The NOEC from one species was 2,000 µg/L based on growth.

C. Terrestrial Toxicity

Aluminium is the most abundant metallic element in the Earth's crust, with a proportion of around 8% by weight, and the third most abundant of all elements. Due to its reactive nature, it does not exist as free elemental metal, rather it occurs in hundreds of different compounds and minerals. Against the background of this abundance and taking into account available data on the anthropogenic input to the terrestrial environment it is reasoned that aluminium from anthropogenic sources is negligible, both in terms of added amounts as well as in terms of toxicity (ECHA).

D. Calculation of PNEC

The PNEC calculations for aluminium follow the methodology discussed in DEWHA (2009).

$PNEC_{water}$

The ANZG water quality guideline (2018) derived a moderate reliability DGV of 55 µg/L for aluminium at pH >6.5 using the statistical distribution method (Burr distribution as modified by SCIRO, Section 8.3.3.3) with 95% protection and an ACR of 8.2. A freshwater low-reliability trigger value of 0.8 µg/L was derived for aluminium at pH of <6.5 using an AF of 20 (essential element) on the low pH trout figure. The low-reliability figures should only be used as indicative interim working levels (ANZG, 2018).

[4] Chronic toxicity values were a mixture of LC/EC_{50} LOEC, MATC, and NOEC values; where stated, these were converted to NOEC equivalents.

$PNEC_{sediment}$

No experimental toxicity data on sediment organisms are available. Octanol/water partition coefficient (K_{ow}) and organic carbon-water partition coefficient (K_{oc}) parameters do not readily apply to inorganics, such as aluminium. Thus, the equilibrium partitioning method cannot be used to calculate the $PNEC_{sed}$. The potential of aluminium for adsorption to sediment and soil particles is mainly driven by its speciation and the concentration of dissolved organic carbon (DOC). Based on its properties, the assessment of this compartment will be covered by the aquatic assessment.

$PNEC_{soil}$

Limited experimental toxicity data on soil organisms are available. The potential of aluminium for adsorption to sediment and soil particles is mainly driven by its speciation and the concentration of dissolved organic carbon (DOC). K_{oc} and K_{ow} parameters do not readily apply to inorganics, such as aluminium. Thus, the equilibrium partitioning methods cannot be used to calculate the $PNEC_{soil}$. Based on its properties, the assessment of this compartment will be covered by the aquatic assessment.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Biodegradation is not applicable to inorganic substances. For the purposes of this PBT assessment, the persistent criteria are not considered applicable to aluminium.

Based on the data available, aluminum is considered to have a low bioaccumulation potential to aquatic organisms under circum neutral conditions. Thus, aluminium is not expected to bioaccumulate and does not meet the screening criteria for bioaccumulation.

The lowest chronic NOEC value in fish, invertebrates and algae for aluminium is <0.1 mg/L; thus, aluminium meets the screening criteria for toxicity.

The overall conclusion is that aluminium is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Pyr. Sol. Category 1

Water-react. Category 2

B. Labelling

Danger

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Do not use water, foam or carbon dioxide. May react violently or explosively on contact with water. Can produce corrosive solutions on contact with water. Use dry sand, graphite powder, dry sodium chloride-based extinguishers, or class D extinguishers.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

May re-ignite after fire is extinguished.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice. Do not touch or walk through the spilled material.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed. Eliminate all ignition sources from immediate area.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

The workplace exposure standards for Aluminium, soluble salts (as Al) in Australia is as follows for time weighted average: 2 mg/m^3.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required unless aluminium is in a powdered form. In this case, a positive pressure self-contained breathing apparatus should be worn.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Aluminium is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Treat under anhydrous conditions to prevent reactions. Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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ALUMINIUM OXIDE (CORUNDUM) [1344-28-1]
FLY ASH [68131-74-8]
GRANULATED BLAST FURNACE SLAG [65996-69-2]

This dossier on aluminium oxide (also referred to as corundum), fly ash and granulated blast furnace slag presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. Limited information is available for fly ash and granulated blast furnace slag. However, they are expected to have similar environmental concerns as aluminium oxide.

This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Aluminium oxide, fly ash and granulated blast furnace slag are classified as **tier 1** chemicals and require a hazard assessment only.

1 BACKGROUND

Aluminium oxide or alumina, (Al_2O_3), is an inert, odourless, white amorphous material often used in industrial ceramics. Due to its outstanding properties, alumina has contributed to a significant number of life-extending and society-enhancing applications.

Due to aluminium oxide's hardness, bio-inertness and chemical properties, it is a preferred material for bearings in hip replacements, as prostheses, bionic implants, prosthetic eye substitutes, tissue reinforcements, dental crowns, abutments, bridges and other dental implants. It is also used in lab equipment and tools like crucibles, furnaces and other labware.

Fly ash is the residuum from the burning of a combination of carbonaceous materials. The following elements may be present as oxides: aluminium, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulphur, titanium, and vanadium.

Granulated blast furnace slag is the fused substance formed by the action of a flux upon the gangue of the iron-bearing materials charged to a blast furnace and upon the oxidized impurities in the iron produced. Depending upon the particular blast furnace operation, the slag is composed primarily of sulphur and oxides of aluminium, calcium, magnesium, and silicon.

All three substances are of little toxicological concern to humans and the environment.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): oxo[(oxoalumanyl)oxy]alumane

CAS RN: 1344-28-1

Molecular formula: Al_2O_3

Molecular weight: 101.961 g/mol

Synonyms: Bauxite; Ceramic-Alumina; Corundum; oxide, aluminium

Chemical Name (IUPAC): Ashes (residue)

CAS RN: 68131-74-8

Molecular formula: Unspecified, UVCB Substance

Molecular weight: Unspecified, UVCB Substance

Synonyms: fly ash; ash byproduct (coal); cinders

Chemical Name (IUPAC): Aluminium-Calcium-Magnesium-Silicium oxide equivalent

CAS RN: 65996-69-2

Molecular formula: ~ $Al_{(n)}Ca_{(m)}Mg_{(o)}Si_{(p)}O(3n/2+m+o+2p)$

Molecular weight: Unspecified, UVCB Substance

Synonyms: granulated blast furnace slag; slags, ferrous metal, blast furnace

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Aluminium Oxide, Fly Ash and Granulated Blast Furnace Slag

Property	Aluminium Oxide	Klimisch Score	Reference	Fly Ash[1]	Klimisch Score	Reference	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Solid: particulate/powder	2	ECHA	Greyish, black powder (solid)	2	ECHA	inorganic, odourless, grey solids	1	ECHA
Melting Point	2000°C @101.3 kPa	2	ECHA	>640°C @101.3 kPa	2	ECHA	1400°C @101.3 kPa	2	ECHA
Boiling Point	>2900 to 2980°C @101.3 kPa (assumed pressure)	2	ECHA	Not applicable	-	ECHA	2000°C @101.3 kPa	-	ECHA
Density	>3970 - < 3990 kg/m³@ 20°C	1	ECHA	>600- < 1500 kg/m³@ 20°C	1	ECHA	700-1400 kg/m³@ 20°C	2	ECHA
Vapor Pressure	Not relevant melting point is greater than 300 °C	-	ECHA	Not relevant melting point is greater than 300 °C	-	ECHA	Not relevant melting point is greater than 300 °C	-	ECHA
Partition Coefficient (log K_{ow})	The study does not need to be conducted because the substance is inorganic.	-	ECHA-	The study does not need to be conducted because the substance is inorganic.	-	ECHA-	The study does not need to be conducted because the substance is inorganic.	-	ECHA-
Dissociation Constant (pKa)	The study does not need to be conducted because the substance is insoluble.	-	ECHA	The study does not need to be conducted because the substance is insoluble.	-	ECHA	The study does not need to be conducted because the substance is insoluble.	-	ECHA
Water Solubility	0 g/L @ 20°C	1	ECHA	0.743 to 4100 g/L @ 21°C and pH 10.12-12.8	1	ECHA	0.0001 g/L @ 20°C	1	ECHA
Viscosity	Not applicable, substance is a solid	-	ECHA	Not applicable, substance is a solid	-	ECHA	Not applicable, substance is a solid	-	ECHA

1 – Based on ashes (residues), coal (EC Number 931-322-8

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for aluminium oxide, fly ash or granulated blast furnace slag.

NICNAS has assessed aluminium oxide in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to the environment.[1]

NICNAS has assessed granulated blast furnace slag in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to human health.[2]

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

These are inorganic substances that are not subject to biodegradation, are not expected to bioaccumulate, and have a low potential to adsorb to soil.

B. Biodegradation

Aluminium oxide is an inorganic substance. According to Annex VII of the REACH regulations (ECHA), biodegradation testing for inorganic chemicals is not required.

C. Environmental Distribution

Environmental distribution or mobility of a substance is mainly driven by the adsorption potential. The potential of aluminium for adsorption to sediment and soil particles is mainly driven by its speciation and the concentration of dissolved organic carbon (DOC) (ECHA).

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=138d433e-f36b-1410-8c14-0026b2c59b62
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=b9c5433e-f36b-1410-8de4-00e8f2afc108

For evaluation of adsorption at different pH-levels, a chemical simulation was performed. In the stimulation, the amount of aluminium bound to particles because of surface complexation (i.e. adsorption) was pH dependent but was typically less than 8% of the total aluminium at pH 6 and was further reduced to below 1% at pH values above 7. This distribution was similar in both soft and hard waters. The corresponding Log Kd values for this distribution are between 3 and 5. Very similar results were obtained with higher DOC concentrations of 4 mg/L (ECHA)[KI Score =2].

Ferrous slags contain tightly bound heavy metals of low solubility resulting in high partition (Kd) values for the distribution of these metals in the solid/liquid phase (ECHA).

D. Bioaccumulation

The available evidence shows the absence of aluminium biomagnification across trophic levels both in aquatic and terrestrial food chains. The existing information suggests not only that aluminium does not biomagnify, but rather that it tends to exhibit biodilution at higher trophic levels in the food chain (ECHA) [KI Score =2].

Bioaccumulation of trace elements released from slag, is negligible in the environment (ECHA).

The bioaccumulation potential of ashes (residues) is low (ECHA).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Aluminium oxide is of low acute toxicity concern to aquatic organisms, in part because of the effect of pH changes from the dissociated hydrogen ion.

B. Aquatic Toxicity

Data available on aluminium oxide have been generated to demonstrate bioavailability of aluminium in acid water. Adequate studies were found to evaluate the intrinsic toxicity of aluminium oxide. Nonetheless, aluminium oxide is not expected to pose a substantial acute toxicity concern to aquatic receptors (ECHA) [KI Score =2].

In general, it has been shown that ferrous slags of all types tested are not toxic to fish, aquatic invertebrates and algae in both short and long-term studies (ECHA).

The ashes (residues), coal with higher content of free lime indicated slightly harmful effects to aquatic organisms whereas other ashes (residues), coal are not harmful to aquatic organisms. The heavy metal content of the tested substance had no influence on toxic effects on aquatic organisms. Measured data from the aquatic tests show that the bioavailability of the heavy metals is low. Two aqueous solutions prepared from ashes (residues), coal with higher content of free lime and the control solutions were further analysed for macro and trace elements. The concentration of trace metals in the water accommodated fractions (WAFs) were found to be very low. Most elements, which are known to have negative effects on health and environment were either not detected or found in lower concentrations compared to the controls. The concentrations of all elements measured were found in the range of µg/L or below detection limit. Even ashes with a higher content on Cu (249 mg/kg) and Ni (351 mg/kg) showed no toxicity in all aquatic tests, and these

results reveal that metals are mainly in insoluble forms and not bioavailable under normal environmental conditions (ECHA).

C. Terrestrial Toxicity

No data are available for aluminium oxide.

Studies conducted on ferrous slag did not exhibit terrestrial toxicity in soil macroorganisms, soil microorganisms, arthropods, plants and birds (ECHA).

Terrestrial studies with earthworm, plants and microorganisms are available for fly ash and show only low toxicity at high test concentrations. The test substance is not classified as toxic or harmful. Furthermore, the bioaccumulation potential is low and thus the test substance is considered to cause low hazard to predators (ECHA).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Aluminium oxide, fly ash and granulated blast furnace slag are inorganic minerals. Thus, biodegradation is not applicable to these substances. For the purposes of this PBT assessment, the persistent criteria are not considered applicable.

Aluminium oxide is a naturally inorganic substance and as an inorganic complex is not expected to bioaccumulate. Similar potential for bioaccumulation of trace metals or residues associated with ash or slag is low. Thus, these substances do not meet the screening criteria for bioaccumulation.

No aquatic toxicity studies are available for aluminium oxide. It is not expected to pose a substantial acute toxicity concern to aquatic receptors. Fly ash and granulated blast furnace slag also exhibit low toxicity. Thus, these substances do not meet the screening criteria for toxicity.

Thus, aluminium oxide, fly ash and granulated blast furnace slag are not PBT substances.

B. Other Characteristics of Concern

No other characteristics of concern were identified for aluminium oxide, fly ash and granulated blast furnace slag.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Aluminium oxide	1344-28-1	Not a PBT	No	No	NA	No	No	No	1	1	1
Fly ash	68131-74-8	Not a PBT	No	No	NA	No	No	No	1	1	1
Granulated Blast Furnace Slag	65996-69-2	Not a PBT	No	No	NA	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

European Chemicals Agency [ECHA]. ECHA REACH database. http://echa.europa.eu/information-on-chemicals/registered-substances

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Industrial Chemicals Environmental Management Standard [IChEMS]. (2022). Australian Environmental Criteria for Persistent, Bioaccumulative and/or Toxic Chemicals. https://www.dcceew.gov.au/sites/default/files/documents/australian-pbt-criteria.pdf

Klimisch, H. J., Andreae, M., and Tillmann, U. (1997). A systematic approach for evaluating the quality of experimental and toxicological and ecotoxicological data. *Regul. Toxicol. Pharmacol. 25*:1–5.

B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DOC	dissolved organic carbon
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
hPa	hectopascal
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg/m3	kilogram per cubic metre
KI	Klimisch scoring system
kPa	kilopascal
mg/L	milligrams per litre
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases

ALUMINIUM STEARATE

This dossier on aluminium stearate presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): Aluminium trioctadecanoate

CAS RN: 637-12-7

Molecular formula: $C_{54}H_{105}AlO_6$

Molecular weight: 877.41 g/mol

Synonyms: Aluminium stearate, Aluminium octadecenoate, Stearic acid, aluminium salt

SMILES: [Al+3].CCCCCCCCCCCCCCCCCC([O-])=O.CCCCCCCCCCCCCCCCCC([O-])=O.CCCCCCCCCCCCCCCCCC([O-])=O

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of aluminium stearate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	White coloured powder	2	ECHA
Melting Point	179.5°C @ 101.3 kPa	2	ECHA
Boiling Point	250°C @ 101.3 kPa	2	ECHA
Density	1066 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	0 Pa @ 25°C	2	ECHA
Partition Coefficient (log K_{ow})	22.69 @ Temperature not listed	2	ECHA
Water Solubility	0 g/L @ 25°C	2	ECHA
Flash Point	199.6°C	2	ECHA
Auto flammability	375°C	2	ECHA
Viscosity	Substance is a solid. Study not conducted.	-	-
Henry's Law Constant	0.0067 Pa m^3/mol@ Temperature not listed	2	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Aluminium stearate is readily biodegradable. It is not expected to bioaccumulate. It is expected to be immobile in soil and strongly adsorb to soil or sediment.

B. Biodegradation

Aluminium stearate is readily biodegradable. Based on QSAR version 3.3, there was 77% predicted degradation after 28 days, as determined by carbon dioxide evolution (ECHA) [Kl. Score = 2].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

Based on a soil organic carbon partition coefficient (K_{oc}) of 1x10^10 L/kg, aluminium stearate is expected to be immobile in soil, and it is expected to strongly adsorb to soil or sediment (ECHA).

D. Bioaccumulation

Based on a low estimated BCF of 3.162 L/kg and experimental BCF range of 2.2 to 813 L/kg, aluminium stearate has low potential for bioaccumulation (ECHA). While its log K_{ow} of 22.69 (ECHA) indicates high lipid affinity, uptake is likely limited by molecular size and membrane permeability.

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Aluminium stearate has a low potential for acute oral and dermal toxicity. This material is not irritating to the skin and eyes and is not a skin sensitiser. Aluminium stearate was non-genotoxic in *in vitro* models. No data was available from repeat dose toxicity studies.

B. Metabolism

No data available

C. Acute Toxicity

Oral

In an acute oral toxicity study, rats were treated with aluminium trioctadecanoate in the concentration of 5000 mg/kg bw orally. No mortality was observed in treated rats at 5000 mg/kg bw when rats were treated with aluminium trioctadecanoate orally (ECHA) [KI. score=2].

Inhalation

No data available

Dermal

In an acute dermal toxicity study, Guinea pigs were treated with aluminium trioctadecanoate in the concentration of 3000 mg/kg bw dermally. No mortality was observed in treated Guinea pigs at 3000 mg/kg bw. Therefore, LD50 was > 3000 mg/kg bw when Guinea pigs were treated with aluminium trioctadecanoate dermally (ECHA) [Kl. score=2].

D. Irritation

Skin

The dermal irritation potential of aluminium stearate was determined according to OECD 439 guidelines. The MatTek EpiDerm™ model was used to determine the viability of the tissues following exposure for 1 hour, followed by a 42-hour post-exposure recovery period. The viability of each tissue was determined by MTT assay. The Mean % tissue viability compared to negative control (n=3) of Aluminium tristearate was determined to be 91.7% and therefore, for considered to be a skin irritant (ECHA) [Kl. score=2].

Eye

The ocular irritation potential of aluminium tristearate was estimated using OECD QSAR toolbox v3.3 with logPow as the primary descriptor. Aluminium tristearate was estimated to be not irritating to the eyes of Himalayan rabbits. Based on the estimated results, aluminium tristearate was not irritating to eyes (ECHA) [Kl. score=2].

E. Sensitisation

The skin sensitisation potential of aluminium trioctadecanoate was estimated by using OECD QSAR toolbox v3.3 with log K_{ow} as the primary descriptor and considering the six closest read across substances. Aluminium trioctadecanoate was predicted to be non-sensitizing to the skin of male and female Hartley guinea pig (ECHA) [KI. score=2].

F. Repeated Dose Toxicity

Oral

No data available

Inhalation

No data available

Dermal

No data available

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on aluminium stearate are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on aluminium stearate

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial reverse mutation assay	-	-	2	ECHA
Gene mutation study in mammalian cells	-	-	2	ECHA

*+, positive; -, negative

In Vivo Studies

No data available

H. Carcinogenicity

Oral

No data available

Inhalation

No data available

Dermal

No data available

I. Reproductive Toxicity

No data available

J. Developmental Toxicity

Oral

No data available

Inhalation

No data available

Dermal

No data available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for aluminium stearate follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

TRVs were not derived for aluminium stearate. The Australian drinking water guideline values (ADWG) for aluminium may be applicable (ADWG, 2011).

ADWG has concluded that there is insufficient data to set a guidance value for aluminium based on health considerations. Based on aesthetic problems caused by post-flocculation, the concentration of acid-soluble aluminium in drinking water should not exceed 0.2 mg/L. Water authorities are strongly encouraged to keep acid-soluble aluminium concentrations as low as possible, preferably below 0.1 mg/L (ADWG, 2011).

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Aluminium stearate does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Aluminium stearate is highly insoluble in water (solubility of <0 g/L). Thus, it is expected to have low acute and chronic toxicity to aquatic organisms. The exposure risk to soil dwelling organisms is moderate to low.

B. Aquatic Toxicity

Acute Studies

No experimental studies are available for aluminium stearate. Aquatic toxicity is unlikely to occur as the substance is highly insoluble (ECHA).

Chronic Studies

No experimental studies are available for aluminium stearate.

A. Terrestrial Toxicity

No studies available. Aluminium stearate is not persistent in soil. The exposure risk to soil dwelling organisms is moderate to low (ECHA).

C. Calculation of PNEC

The PNEC calculations for aluminium stearate follow the methodology discussed in DEWHA (2009).

PNEC Water

Aluminium stearate is highly insoluble. Aquatic toxicity data is unavailable as aquatic toxicity is unlikely to occur. A $PNEC_{water}$ was not derived.

PNEC Sediment

No experimental toxicity data on sediment organisms are available. Octanol/water partition coefficient (K_{ow}) and organic carbon-water partition coefficient (K_{oc}) parameters do not readily apply to inorganics, such as aluminium stearate. Thus, the equilibrium partitioning method cannot be used to calculate the $PNEC_{sed}$. Based on its properties, aluminium stearate is expected to be immobile in sediment and strongly adsorb to sediment. Assessment of this compartment will be covered by the aquatic assessment.

PNEC Soil

No experimental toxicity data on soil organisms are available. The environmental distribution of aluminium stearate is dominated by its water solubility. Sorption of aluminium stearate should probably be regarded as a reversible situation, *i.e.*, the substance is not tightly nor permanently bound. K_{oc} and K_{ow} parameters do not readily apply to inorganics, such as aluminium stearate. Thus, the equilibrium partitioning methods cannot be used to calculate the $PNEC_{soil}$. Based on its properties, aluminium stearate is expected to be immobile in soil and strongly adsorb to soil. Assessment of this compartment will be covered by the aquatic assessment.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Aluminium stearate is readily biodegradable and thus does not meet the screening criteria for persistence.

Based on a low estimated BCF of 3.162 L/kg and experimental BCF range of 2.2 to 813 L/kg, aluminium stearate does not meet the criteria for bioaccumulation.

No aquatic toxicity data is available for aluminium stearate due to its high insolubility in water. Aquatic toxicity is unlikely to occur. Thus, aluminium stearate does not meet the criteria for toxicity.

The overall conclusion is that aluminium stearate is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Not classified

B. Labelling

None

C. Pictogram

None

X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Do not use water as straight stream directly on spilled material. Use carbon dioxide, foam, or dry chemical. Do not use halogenated extinguishing agents on spilled material.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

Workplace exposure standards for aluminium stearate have not been established in Australia.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Aluminium stearate is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Aluminium compounds are treated under anhydrous conditions to prevent violent reactions. Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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AMIDES, TALL OILS FATTY, N,N-BIS(HYDROXYETHYL)

This dossier on amides, tall oils fatty, N,N-bis(hydroxyethyl) presents the most critical studies pertinent to the risk assessment of amides, tall oils fatty, N,N-bis(hydroxyethyl) in its use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997; Kl).

Screening Assessment Conclusion – Amides, tall oils fatty, N,N-bis(hydroxyethyl) was not identified in chemical databases used by NICNAS as an indicator that the chemical is of concern and is not a PBT substance based on data from read-across substance oleamide DEA. Amides, tall oils fatty, N,N-bis(hydroxyethyl) was assessed as a tier 2 chemical for acute and chronic toxicity. Therefore, Amides, tall oils fatty, N,N-bis(hydroxyethyl) is classified overall as a **tier 2** chemical and requires a hazard assessment and qualitative assessment of risk.

1. BACKGROUND

While no specific composition data are available on amides, tall oils fatty, N,N-bis(hydroxyethyl), it is expected to be a mixture of diethanolamides of the fatty acids that constitute tall oil, which is composed of predominantly C18 unsaturated fatty acids: 48% oleic acid, 35% linoleic acid, 7% conjugated linoleic acid.

As there are no available studies on amides, tall oils fatty, N,N-bis(hydroxyethyl) (CAS RN 68155-20-4), this dossier is based on information on amides, C18-unsatd, N,N-bis(hydroxyethyl) (CAS RN 93-83-4). This is justified because amides, tall oils fatty, N,N-bis(hydroxyethyl) is predominantly diethanolamides of unsaturated C18 fatty acids similar to the composition of the target substance (CAS RN 68155-20-4).

Amides, C18-unsatd, N,N-bis(hydroxyethyl) (also known as oleamide DEA) are readily biodegradable, have a moderate potential to sorb to sediments and soil, and a low potential to bioaccumulate. The acute toxicity of oleamide DEA is low by the oral and dermal routes. It is a skin and eye irritant. However, it is not considered a skin sensitiser. It is not toxic via repeated doses, has no reported reproductive or developmental effects, and is not considered genotoxic or carcinogenic. It has a moderate toxicity to aquatic organisms and low toxicity to terrestrial organisms.

2. CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Amides, tall oils fatty, N,N-bis(hydroxyethyl)

CAS RN: 68155-20-4

Molecular Formula: $C_{22}H_{43}NO_3$ (UVCB substance)

Molecular Weight: Unspecified (Substance is a UVCB)

Synonyms: N,N-bis(2-hydroxyethyl)tall oil acid amide; N,N-bis(2-hydroxyethyl)tall oil fatty amides; Diethanolamine tall oil acid amide; tall oil acid diethanolamide; tallamide DEA; tall oil fatty acid

diethanolamide; tall oil fatty acids, diethanolamide; tall oil fatty acids, diethanolamide condensate; tall oil fatty acids, diethanolamine amide

Chemical Name (IUPAC): Oleamide DEA

CAS RN: 93-83-4

Molecular formula: $C_{22}H_{43}NO_3$ (UVCB substance)

Molecular weight: 369.6 g/mol (UVCB substance)

Synonyms: Oleyl diethanolamide;(9Z)-N,N-Bis(2-hydroxyethyl)-9-octadecenamide; (z)-n,n-bis(2-hydroxyethyl)-9-octadecenamide; 9-Octadecenamide, N,N-bis(2-hydroxyethyl)-, (Z)-; Alkamide DO-280;N,N-Bis(2-hydroxyethyl)-9-octadecenamide; Alrosol O; Amisol ode; Clindrol 2000; Clindrol 2020, Comperlan OD; Diethanololeamide; EMID 6545; Emulsifier WHC; Lauridit OD; Mackamide O, Marlamid D 1885, N,N-Diethanololeamide, Nitrene NO, Oleamide, N,N-bis(2-hydroxyethyl)-, Oleic acid diethanolamide, Oleic acid diethanolamine condensate, Oleic diethanolamide, Schercomid ODA, Stafoam DO, Steinamid DO 280SE, Witcamide 511C

3. PHYSICO-CHEMICAL PROPERTIES

No information is available on amides, tall oils fatty, N,N-bis(hydroxyethyl). Key physical and chemical properties for the surrogate substance (oleamide DEA) are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Oleamide DEA [CAS RN 93-83-4]

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Brown liquid	2	ECHA
Melting point	Approximately -80°C @ 101.3 kPa	1	ECHA
Boiling point	>300°C, decomposes before boiling	1	ECHA
Density	967 kg/m^3@ 20°C	1	ECHA
Vapour pressure	0 Pa @ 20°C	1	ECHA
Partition coefficient (log K_{ow})	>6 (experimental)	1	ECHA
Dissociation Constant (pKa)	Not relevant	-	ECHA
Water solubility	0.0001 g/L @ 20°C	2	ECHA
Viscosity	805.87 mPa.s @ 20°C	1	ECHA

4. DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for amides, tall oils fatty, N,N-bis(hydroxyethyl).

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5. ENVIRONMENTAL FATE SUMMARY

A. Summary

Read-across substance oleamide DEA is readily biodegradable, has a moderate potential to sorb to sediments and soil, and a low potential to bioaccumulate.

B. Biodegradation

Oleamide DEA is readily biodegradable. In an OECD 301 D test, degradation was 70% after 28 days (ECHA) [KI. score = 1]. In an OECD 301 B test, degradation was 79% after 14 days and 86% after 28 days (ECHA) [KI. score = 1]. If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

No experimental data are available for Oleamide DEA. Using KOCWIN v2.00, the estimated soil organic carbon partition coefficient (K_{oc}) values for the individual components were calculated using the molecular connectivity index (MCI) approach. The final K_{oc} value was calculated on a weighted-average basis using the mole fractions of the individual components. The final K_{oc} value is 1,717 L/kg.

When released to the environment, oleamide DEA, based on its low water solubility and high K_{oc} value, is likely to adsorb to soil or sediment and has a low potential for mobility.

D. Bioaccumulation

There are no bioaccumulation studies on oleamide DEA. The bioaccumulation potential of oleamide DEA was estimated using BCFBAF v3.01. The final BCF was calculated on a weighted-average basis using the mole fractions of all individual components. The calculated BCF was 112.53 L/kg, indicating a low potential for bioaccumulation (ECHA).

6. HUMAN HEALTH HAZARD ASSESSMENT

Human health toxicity data were obtained from ECHA, unless another source is explicitly cited.

A. Summary

The acute toxicity of read-across substance oleamide DEA is low by the oral and dermal routes. It is a skin and eye irritant. However, it is not considered a skin sensitiser. It is not toxic via repeated doses, has no reported reproductive or developmental effects; and, is not considered genotoxic or carcinogenic.

B. Acute Toxicity

Oleamide DEA is not considered acutely toxic via oral route of exposure, with an LD_{50} of 10,000 mg/kg in male Sprague-Dawley rats (ECHA) [Kl. Score = 1].

There are no acute inhalation toxicity studies on oleamide DEA. Based on the physical properties of the substance (i.e., vapour pressure), the studies did not need to be conducted (ECHA).

A study was conducted to determine the acute dermal toxicity of oleamide DEA and a read-across substance [amides, C8-18 (even-numbered)] in male and female albino rabbit. No adverse effect was observed. The acute dermal LD_{50} was found to be > 2,000 mg/kg bw (ECHA) [Kl. Score = 2].

C. Irritation

Based on the available data, the test substance is considered irritating to both the skin and eyes. The available in vivo studies demonstrate:

- Clear irritation response following semi-occlusive exposure to the test substance for 24 hours. The data support a classification as Skin Irrit. 2 - H315 (causes skin irritation) according to CLP (EC 1272/2008) criteria (ECHA) [Kl. Score =1].
- Undiluted test substance showed irritation to rabbit eyes and supports classification as Eye Irrit. 2 – H319 (causes serious eye irritation) according to CLP (EC 1272/2008) criteria (ECHA) [Kl. Score = 1].

D. Sensitisation

The test substance is not expected to be a skin sensitiser based on a negative in vivo skin sensitisation study conducted on a structurally similar substance (ECHA) [Kl. Score = 2]. Therefore, no classification is required for sensitisation according to CLP (EC 1272/2008) criteria. There are no data on the respiratory sensitization potential of the substance.

E. Repeated Dose Toxicity

Oral

An oral subacute study was conducted to determine the repeated dose oral toxicity of oleamide DEA and the read across substance [amides, C12-18 (even-numbered)] to rats. Groups of 10 male and 10 female rats were orally gavaged with the substance diluted in olive oil, 5 d/wk for 28 days at doses of 0, 70, 250, 750 (Days 1-14) and 1500 (Days 15-28) mg/kg bw/d. Clinical signs, bodyweight, hematology, clinical chemistry, urinalysis, gross and microscopic pathology were recorded.

Additional groups of 5 male and 5 female rats were kept for a 4-month recovery period. No treatment-related adverse effects were observed at any of the doses. Changes in the forestomach at some doses including controls were attributed to the use of olive oil and found to be reversible after end of exposure. Under the conditions of the study, the 28-day NOAEL to rats was therefore considered to be greater than 750 mg/kg bw/day (Potokar, 1983 as cited in ECHA) [Kl. Score = 2].

In a combined repeated dose toxicity study with the reproduction/developmental toxicity screening test, doses of 0, 100, 250, and 700 mg/kg/day were administered via oral gavage to 45 male and 57 female rats once per day for up to 34 days for males and up to 63 days for females. No treatment-related adverse effects were observed at any of the doses. Under the conditions of the study, the 28-day NOAEL to rats for general toxicity was 700 mg/kg bw/day (ECHA) [KI. Score = 1].

Based on the findings of the oral subacute studies, the test substance is not considered to meet the requirements for repeated dose toxicity classification according to CLP (EC 1272/2008) criteria.

Inhalation

There are no data to evaluate the repeated dose toxicity classification for the inhalation exposure route.

Dermal

A 2-year study was conducted to evaluate the effects of chronic exposure to the test substance in F344/N rats. Groups of 50 male and 50 female rats were dermally exposed to 0, 50 or 100 mg/kg bw/day in ethanol at a frequency of 5 d/wk for a period of 104 weeks. Survival, clinical findings, body weight and histopathology of different organs were assessed at specific time intervals. Survival of the dosed male and female rats was similar to that of the vehicle control groups. The mean body weights of males and females (Week 24 onwards) were reduced compared to the vehicle control group at 100 mg/kg bw/day. A dose dependent increase in irritation (mild to moderate) and non-neoplastic lesions (minimal to moderate) of the skin were observed at the site of application in all animals. The non-neoplastic lesions included epidermal hyperplasia, sebaceous gland hyperplasia, hyperkeratosis, parakeratosis, chronic active dermal inflammation and ulcer. No significant neoplastic lesions or evidence of carcinogenic activity was observed at any tested dose levels in skin, testis and thyroid gland. Under the conditions of the study, the NOAEL for systemic effects was 50 mg/kg bw/d and the LOAEL for local effects was at the lowest dose of 50 mg/kg bw/d (Irwin, 1999 as cited in ECHA) [Kl. Score = 1].

Based on the findings of a chronic dermal study in rat (NOAEL of 50 mg/kg bw/day for systemic effects and LOAEL of 50 mg/kg bw/day for local effects), the test substance does not meet the requirements for repeated dose toxicity classification according to CLP (EC 1272/2008) criteria.

F. Genotoxicity

The test substance (oleamide DEA) and read-across substance (amides, C8-18 (even numbered)) were negative in short-term in vitro and in vivo genotoxicity tests. Therefore, no classification is required for this endpoint according to CLP (EC 1272/2008) criteria.

In Vitro Studies

The *in vitro* studies conducted for this substance are described in Table 3. The referenced studies indicate that the substance is not mutagenic or genotoxic *in vitro*.

Table 3 In vitro Genotoxicity Studies**

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
In vitro gene mutation study in bacteria (*S. typhimurium* TA97, TA98, TA100 and TA1535)	-	-	2	Irwin, 1999
In vitro chromosome aberration study in mammalian cells (Chinese hamster ovary [CHO])	-	-	2	NTP, 2001
In vitro Mammalian Cell Micronucleus Test (Human lymphocytes)	-	-	1	Geissel, 2021
Mammalian cell gene mutation (mouse lymphoma L5178Y cells)	-	-	1	Irwin, 1999

*+, positive; -, negative.
** As cited in ECHA.

In Vivo Studies

A study was conducted to evaluate the potential of the test material to induce micronuclei in B6C3F1 mice. Under the conditions of the study, the test substance did not increase the frequencies of micronucleated normochromatic erythrocytes (NCEs) in peripheral blood in either male or female mice at the end of 13 weeks (ECHA) [Kl. Score = 1].

G. Carcinogenicity

Oral

No studies are available.

Inhalation

No studies are available.

Dermal

Rodent tests indicate that the substance is not carcinogenic by the dermal route. A study was conducted to evaluate the effects of chronic exposure to the test substance in B6C3F1 mice. Under the test conditions, no evidence of carcinogenic activity was observed with the test substance at any tested dose levels in mice [Kl. Score = 1]. A study was conducted to evaluate the effects of chronic exposure to the test substance in F344/N rats. Under the test conditions, no evidence of

carcinogenic activity was observed with the test substance at any tested dose levels in rats (ECHA) [Kl. Score = 1].

H. Reproductive Toxicity

In a combined repeated dose toxicity study with the reproduction/developmental toxicity screening test conducted under OECD Guideline 422 administered doses of 0, 100, 250, and 700 mg/kg/day via oral gavage to 45 male and 57 female rats once per day for up to 34 days for males and up to 63 days for females. No treatment-related adverse effects were observed at any of the doses for the adults or pups. The NOAEL to rats was identified as greater than 700 mg/kg bw/day (ECHA) [KI. Score = 1].

I. Developmental Toxicity

No adverse developmental effects were observed following administration of 1,000 mg/kg bw day to pregnant Sprague-Dawley rats (ECHA) (Kl. Score = 2).

J. Derivation of Toxicological Reference and Drinking Water Guidance Values

The toxicological reference values developed follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

Non-Cancer

Oral

In a combined repeated dose toxicity study with the reproduction/developmental toxicity screening test, the NOAEL was 700 mg/kg bw/day, for general toxicity in male and female rats. (Longobardi, 2022 as cited in ECHA). This NOAEL of 700 mg/kg-day will be used for determining the oral reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:
UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1

Oral RfD = 700/(10 x 10 x 1 x 10 x 1) = 700/1000 = 0.70 mg/kg-day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:
Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)

Drinking water guidance value = (0.70 x 70 x 0.1)/2 = 2.45 mg/L

Cancer

Oleamide DEA was not carcinogenic to rats or mice in chronic oral studies. Therefore, a cancer reference value was not derived.

K. Human Health Hazard Assessment of Physico-Chemical Properties

Oleamide DEA does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

7. ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Oleamide DEA has moderate toxicity to aquatic organisms.

B. Aquatic Toxicity

Acute Studies

Table 4 lists the results of acute aquatic toxicity studies conducted on oleamide DEA.

Table 4 Acute Aquatic Toxicity Studies on Oleamide DEA

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Danio rerio	96-hour LC_{50}	5.1	1	ECHA
Daphnia magna	48-hour EC_{50}	3.2	2	ECHA
Desmodesmus subspicatus	72-hour EC_{50}	18.6	2	ECHA

Chronic Studies

The 28-day NOEC in a fish chronic toxicity study (*Oncorhynchus mykiss)* was 0.32 mg/L [nominal] and 0.26 mg/L [measured] (ECHA) [Kl. score = 1].

The 21-day NOEC in a *Daphnia* reproduction test is 0.1 mg/L [nominal] and 0.07 mg/L [measured] (ECHA) [KI. score = 1].

The 72-hour EC_{10} to *Desmodesmus subspicatus* is 1.4 mg/L (ECHA) [KI. score = 2].

C. Terrestrial Toxicity

A 21-day study conducted under OECD Guideline 208 in six plant species identified a NOEC of 320 mg/kg and a LC_{50} of 1,000 mg/kg (ECHA) [KI. score = 1].

A 28-day study conducted under OECD Guideline 216 in microorganisms in soil with concentrations of 10, 32, 100, 320 and 1000 mg/kg identified a NOEC of greater than 1,000 mg/kg (ECHA) [KI. score = 1].

A long-term 56-day study conducted under OECD Guideline 222 in earthworms identified a NOEC of greater than 1,000 mg/kg (ECHA) [KI. score = 1].

D. Calculation of PNEC

The PNEC calculations for read-across substance oleamide DEA follow the methodology discussed in DEWHA (2009).

PNEC $_{water}$

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (5.1 mg/L), invertebrates (3.2 mg/L), and algae (18.6 mg/L). Results from chronic studies are available for fish (0.26 mg/L), invertebrates (0.07 mg/L), and algae (1.4 mg/L). On the basis that the data consists of short-term and long-term results for three trophic levels, an assessment factor of 10 has been applied to the lowest reported NOEC or EC_{10} value of 0.07 mg/L for invertebrates. The $PNEC_{water}$ is 0.007 mg/L.

PNEC $_{sediment}$

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 0.18 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (33.78/1280) \times 1000 \times 0.007$
$= 0.18$ mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$PNEC_{water}$ = predicted no effect concentration in water

$K_{sed\text{-}water} = 0.8 + [0.2 \times Kp_{sed}/1000 \times BD_{solid}]$
$= 0.8 + [0.2 \times 68.68/1000 \times 2400]$
$= 33.78\ m^3/m^3$

And:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]

$Kp_{sed} = K_{oc} \times f_{oc}$
= 1,717 x 0.04
= 68.68 L/kg

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for the substance calculated from EPISuite™ using the MCI approach is 1,717 L/kg .
f_{oc} = fraction of organic carbon in sediment = 0.04 [default]

PNEC $_{soil}$

In the ECHA REACH database (ECHA), a $PNEC_{soil}$ was derived for read-across substance oleamide DEA using the NOEC of 320 mg/kg and an assessment factor of 10. The $PNEC_{soil}$ was determined to be 32 mg/kg soil dry weight.

8. CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Oleamide DEA is readily biodegradable; thus, it does not meet the screening criteria for persistence.

Based on an estimated BCF value of 113 L/kg, oleamide DEA does not meet the criteria for bioaccumulation.

The lowest chronic NOEC or EC_{10} value for oleamide DEA is <0.1 mg/L. Thus, oleamide DEA meets the criteria for toxicity.

The overall conclusion is that amides, tall oils fatty, N,N-bis(hydroxyethyl) is not a PBT substance based on read-across substance oleamide DEA.

B. Other Characteristics of Concern

No other characteristics of concern were identified for amides, tall oils fatty, N,N-bis(hydroxyethyl) based on read-across substance oleamide DEA.

9. SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Amides, tall oils fatty, N,N-bis(hydroxyethyl)	68155-20-4	Not a PBT	No	No	No	No	No	Yes	2	2	2

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 2 – Hazard Assessment and Qualitative Assessment Only. Develop toxicological profile and PNECs for water and soil and provide qualitative discussion of risk..

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

10. REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
ADWG	Australian Drinking Water Guidelines
AICS	Australian Inventory of Chemical Substances
BCF	bioconcentration factor
BCFBAF	bioconcentration factor/bioaccumulation factor
CAS RN	Chemical Abstract Services Registry Number
CLP	Classification, Labelling and Packaging
COC	constituent of concern
DEA	diethanolamine
DoEE	Department of the Environment and Energy
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
HHRA	enHealth Human Risk Assessment
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
kg/m^3	kilograms per cubic metre
Kl	Klimisch scoring system
KOCWIN™	USEPA organic carbon partition coefficient estimation model
kPa	kilopascal
L/kg	litres per kilogram
LC	lethal concentration
LD	lethal dose
LOAEL	lowest observed adverse effect level
m^3	cubic metre
MCI	molecular connectivity index
mg/kg	milligrams per kilogram
mg/kg bw/day	mg of substance per kg of body weight administered per day.
mg/L	milligrams per litre
mg/m^3	milligrams per cubic metre
mPa.s	millipascal second

NCE	normochromatic erythrocyte
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NOAEL	no observed adverse effect level
NOEC	no observed effective concentration
OECD	Organisation for Economic Co-operation and Development
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
PNEC	Predicted No Effect Concentration
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RfD	Reference Dose
SGG	Synthetic Greenhouse Gases
UVCB	Unknown or Variable Composition, Complex Reaction Products and Biological Materials
USEPA	United States Environmental Protection Agency

AMMONIA (CAS NO. 7664-41-7)
AMMONIUM HYDROXIDE (CAS NO. 1336-21-6)

This dossier on ammonia and ammonium hydroxide presents the most critical studies pertinent to the risk assessment of ammonia and ammonium hydroxide in their use in coal seam gas extraction activities. It does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA) and the OECD-SIDS category for ammonia (OECD, 2007). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Ammonia and ammonium hydroxide were not identified in chemical databases used by NICNAS as an indicator that the chemicals are of concern and are not a PBT substance. Ammonia and ammonium hydroxide was assessed as tier 2 chemicals for acute and chronic toxicity. Therefore, ammonia and ammonium hydroxide are classified overall as **tier 2** chemicals and require a hazard assessment and qualitative assessment of risk.

1 BACKGROUND

Ammonia (CAS No. 7664-41-7) dissolves readily in water to form the solution described as ammonium hydroxide (CAS No. 1336-21-6). In water, ammonia is in equilibrium with the ammonium ion (NH_4^+), depending on the pH. Under environmental conditions (pH 5-8), the predominant form will be the ammonium ion (NH_4^+).

Ammonia or ammonium ion is rapidly converted to nitrate by nitrification under aerobic conditions in the aquatic environment. Ammonia is part of the nitrogen cycle. Biodegradation is not applicable to ammonia or the ammonium ion. Ammonia (or the ammonium ion) is easily mineralised to the nitrite ion (NO_2^-) by numerous species of bacteria. Ammonia is not expected to bioaccumulate in the environment because of its dissociation to the ammonium ion and because it is part of the nitrogen cycles in air, soil and water. Ammonia and the ammonium ion have a low potential to adsorb to soil and sediment.

The acute toxicity of ammonia is moderate by the inhalation route. Depending on the concentration, solutions of ammonia are corrosive, irritating or non-irritating. These solutions cause direct effects to the skin, eyes, respiratory tract and gastrointestinal tract. Vapours from aqueous solutions of ammonia can cause respiratory irritation. No target organ effects were seen in rats given ammonia by oral gavage or in feed for up to two years. Ammonia is not genotoxic. There were no increases in tumours when rats were fed ammonia in their diet for two years. A reproductive and developmental screening toxicity (OECD 422) study showed no reproductive or developmental effects in rats when given oral gavage doses of an aqueous solution of ammonia.

Ammonia is acutely toxic to aquatic life. The ANZG guidelines for fresh and marine water quality (ANZG, 2018) has a freshwaters trigger value of 900 µg/L TOTAL ammonia-N at pH 8.0.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Ammonia

CAS RN: 7664-41-7

Molecular formula: NH_3

Molecular weight: 17 g/mol

Synonyms: Ammonia, ammonia gas, ammonia anhydrous, liquid ammonia

Chemical Name (IUPAC): Ammonium Hydroxide

CAS RN: 1336-21-6

Molecular formula: H_5NO or NH_4OH

Molecular weight: 35.05 g/mol

Synonyms: Ammonia, aqueous solution; aqua ammonia; ammonia, monohydrate; ammonia liquor; ammonia water

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substances are shown in Tables 1 and 2.

Table 1 Overview of the Physico-chemical Properties of Ammonia

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Colourless gas	2	ECHA
Melting Point	-77.7°C @ 101.3 kPa	2	ECHA
Boiling Point	-33.33 °C @ 101.3 kPa	2	ECHA
Vapour Pressure	861,100 Pa @ 20°C	2	ECHA
Partition Coefficient (log K_{ow})	0.23 @ 20 °C	-	ECHA
Water Solubility	482 g/L @ 25°C	2	ECHA
Dissociation constant (pKa)	9.25@ 25°C	2	ECHA

Table 2 Overview of the Physico-chemical Properties of Ammonium Hydroxide

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Colourless aqueous solution	-	NCBI, 2024
Melting Point	-77°C @ 101.3 kPa	2	OECD, 2007
Boiling Point	36°C, pressure not specified	4	OECD, 2007
Vapour Pressure	287,800 Pa @ 20°C	2	OECD, 2007
Partition Coefficient (log K_{ow})	Not applicable	-	OECD, 2007
Water Solubility	Miscible	2	OECD, 2007
Dissociation constant (pKa)	9.25	2	OECD, 2007

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 3). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No other specific environmental regulatory controls or concerns were identified within Australia and internationally for ammonia.

NICNAS has assessed ammonium hydroxide in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to the environment. It is a reactive substance which rapidly converts into species of low ecotoxicological concern. This chemical, and its degradant species, are not expected to pose an unreasonable risk to the environment provided that ANZECC water quality guidelines for physical and chemical stressors are not exceeded[1].

Table 3 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=f98c433e-f36b-1410-8c14-0026b2c59b62

5 ENVIRONMENTAL FATE SUMMARY

Ammonium hydroxide is a solution of ammonia in water. The term 'ammonia' refers to two chemical species of ammonia that are in equilibrium in water: the un-ionised ammonia, NH_3, and the ionised ammonium ion, NH_4^+. The proportion of the two chemical forms in water varies with the physico-chemical properties of the water, particularly pH and temperature.

The following equilibria occurs at ambient environmental conditions:

$NH^+ + H_2O \leftrightarrow NH_3 + H^+$
$NH_3 + H_2O \leftrightarrow NH_4^+ + OH^-$

Under environmental conditions (pH 5-8), the predominant form will be the ammonium ion (NH_4^+). As pH decreases, the concentration of the ammonium ion will increase, while the un-ionised ammonia concentration will decrease.

Ammonia is volatile and once exposed to open air, liquid ammonia quickly turns into a gas and forms ammonia gas. Ammonia is a colourless gas at room temperature and pressure. Gas-phase ammonia will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and nitrate radicals (PubChem).

Ammonia is very soluble in water, the solubility being around 482 g/L at 25°C. Ammonia or ammonium ion is rapidly converted to nitrate by nitrification under aerobic conditions in the aquatic environment (OECD, 2007). Ammonia is part of the nitrogen cycle. Biodegradation is not applicable to ammonia or the ammonium ion. Ammonia (or the ammonium ion) is easily mineralised to the nitrite ion (NO_2^-) by numerous species of bacteria (OECD, 2007).

Ammonia is not expected to bioaccumulate in the environment because of its dissociation to the ammonium ion and because it is part of the nitrogen cycles in air, soil and water. Ammonia and the ammonium ion have a low potential to adsorb to soil and sediment.

6 HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

The acute toxicity of ammonia is moderate by the inhalation route. Depending on the concentration, solutions of ammonia are corrosive, irritating or non-irritating. These solutions cause direct effects to the skin, eyes, respiratory tract and gastrointestinal tract. Vapours from aqueous solutions of ammonia can cause respiratory irritation. No target organ effects were seen in rats given ammonia by oral gavage or in feed for up to two years. Ammonia is not genotoxic. There were no increases in tumours when rats were fed ammonia in their diet for two years. A reproductive and developmental screening toxicity (OECD 422) study showed no reproductive or developmental effects in rats when given oral gavage doses of an aqueous solution of ammonia.

B. Acute Toxicity

Ammonia is a gas therefore oral toxicity is neither relevant nor technically feasible (ECHA).

The 1-hour LC_{50} values of ammonia in rats are 9,850 mg/m^3 for males and 13,770 mg/m^3 for females (Appelman et al., 1982). [Kl. score = 2]

C. Irritation

Application of a 12% aqueous solution of ammonia (as ammonium hydroxide) to the skin of female rabbits for four hours under occlusive conditions was corrosive. A 10% aqueous solution was not corrosive under similar conditions (ECHA). [Kl. score = 2]

No eye irritation studies are available.

D. Sensitisation

No studies are available.

E. Repeated Dose Toxicity

Oral

In a combined repeated dose toxicity study with the reproduction/developmental toxicity screening test (OECD 422), male and female Crj: CD(SD) male and female rats were dosed by oral gavage with 0, 250, 750 or 1,500 mg/kg diammonium phosphate. The exposure period for the toxicity subgroup was 35 days. There was no treatment-related deaths and no clinical signs of toxicity. The 1,500 mg/kg males had reduced (22% of controls) body weight gain and feed consumption. Activated partial thromboplastin time was reduced in the 750 and 1,500 mg/kg males. In males: elevated alkaline phosphatase (750 and 1,500 mg/kg; 132% and 131% of controls); reduced glucose and phosphorus levels (1,500 mg/kg; 79% and 82% of controls); reduced total protein (750 and 1,500 mg/kg; 93% and 91% of controls); slightly elevated albumin/globulin ratio (1,500 mg/kg; 117% of controls). In females: decreased phosphorus levels (1,500 mg/kg; 81% of controls). No details were given as to whether these values were within normal range. The functional observation battery (FOB) and motor activity results showed no treatment-related effects. Relative kidney and liver weights were increased in the 1,500 mg/kg females compared to controls. Reddening of the extremities were seen in all dose groups during the first week of the study but were reduced as the study progressed. Histopathologic examination showed submucosal inflammation of the stomach at all dose levels, which was not statistically significant at 250 mg/kg-day. Given the lack of histopathological findings (excluding the irritation effect seen in stomach), the serum chemistry changes do not seem indicative of an adverse effect. The NOAEL for this study is 250 mg/kg-day and the LOAEL is 750 mg/kg-day (ECHA). [Kl. score = 1]

Male and female F344 rats were fed in their diet 0, 0.1, 0.6 or 3% ammonium sulfate for 52 weeks. The estimated daily intakes were: 0, 42, 256 and 1,527 mg/kg-day for the males; and 0, 48, 284 and 1,490 mg/kg-day for the females. There was a significant increase in kidney and/or liver weights in the 3% dietary group. No effects were noted for survival, body weights, hematology, serum chemistry, or histopathology. The kidney and liver weight changes do not appear to be an adverse effect because of no corresponding serum chemistry and/or histopathological changes in these organs. The NOAEL for this study is 0.6% in the diet, corresponding to 256 and 284 mg/kg-day for males and females, respectively (Ota et al., 2006). [Kl. score = 2]

Male and female F344 rats were fed in their diet 0, 1.5 or 3% ammonium sulfate for 104 weeks. The estimated daily intakes were: 0, 564 and 1,288 mg/kg-day for the males; and 0, 650 and 1,371 mg/kg-day for the females. Body weights and feed consumptions were similar across all groups. There was an increased incidence of chronic nephropathy in the male rats, which was statistically significant only in the 1.5% dietary group (Ota et al., 2006). [Kl. score = 2]

Inhalation

The study of ammonia exposure in workers in a soda ash plant with support from three studies in urea fertilizer plants was identified as the principal study for the derivation of an inhalation reference concentration (RfC). Respiratory effects, characterized as increased respiratory symptoms based on self-report (including cough, wheezing, and other asthma-related symptoms) and decreased lung function in workers exposed to ammonia, were selected as the critical effect. An RfC of 0.5 mg/m^3 was calculated (USEPA, 2016).

Additional information can be found in USEPA's Integrated Risk Information System (IRIS) assessment for ammonia available on-line at:
https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=422

Dermal

No studies are available.

F. Genotoxicity

Table 4 lists the *in vitro* genotoxicity studies on ammonia and ammonium sulfate.

In Vitro Studies

Table 4 *In Vitro* Genotoxicity Studies on Ammonia and Ammonium Sulfate

Test System	Test Substance	Results*		Klimisch Score	Reference
		-S9	+S9		
Bacterial reverse mutation (*S. typhimurium* and *E. coli* strains)	Anhydrous ammonia	-	-	2	ECHA
Bacterial reverse mutation (*S. typhimurium* strains)	Ammonium sulfate	-	-	1	ECHA

*+, positive

In Vivo Studies

Male ddY mice were given a single intraperitoneal injection of 0, 62.5, 125, 250 or 500 mg/kg ammonium chloride. There were no increases in the frequency of micronucleated erythrocytes at any dose level (Hayashi et al., 1988).

Male ddY mice were given intraperitoneal injections of 0, 31.3, 62.6, 125 or 250 mg/kg ammonium chloride on four consecutive days. There were no treatment-related increases in the frequency of micronucleated erythrocytes at any dose level (Hayashi et al., 1988).

G. Carcinogenicity

Male and female F344 rats were fed in their diet 0, 1.5 or 3% ammonium sulfate for 104 weeks. The estimated daily intakes were 0, 564 and 1,288 mg/kg-day for the males; and 0, 650 and 1,371 mg/kg-day for the females. Body weights and feed consumptions were similar across all groups. The tumour incidences were similar between the treated and control groups (Ota et al., 2006). [Kl. score = 2]

H. Reproductive/Developmental Toxicity

In a combined repeated dose toxicity study with the reproduction/developmental toxicity screening test (OECD 422), male and female Crj: CD(SD) male and female rats were dosed by oral gavage with 0, 250, 750 or 1,500 mg/kg diammonium phosphate. The males and females were treated for 28 and 53 days, respectively. There were no reproductive or developmental toxicity at any dose level. The NOAEL for reproductive and developmental toxicity is 1,500 mg/kg-day (ECHA). [Kl. score = 1]

I. Derivation of Toxicological Reference and Drinking Water Guidance Values

Non-Cancer

An oral reference dose was not derived for ammonia.

The Australian drinking water guideline value for ammonia (0.5 mg/L, aesthetics) may be applicable (ADWG, 2011).

Cancer

A two-year rat dietary study on ammonium sulfate showed no carcinogenic effects. Thus, a cancer reference value was not derived.

J. Human Health Hazard Assessment of Physico-Chemical Properties

Ammonia is a flammable gas.

It does not exhibit the following physico-chemical properties:

- Explosivity
- Oxidising potential

7 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Ammonia is moderately toxic to a variety of aquatic and terrestrial organisms. In general the effect concentration is on the order of a low to mid part per million range. Specific data are discussed below.

B. Aquatic Toxicity

ANZG developed a water quality guideline for ammonia (ANZG, 2018). The term 'ammonia' refers to both the un-ionised ammonia (NH_3) and the ionised ammonium ion (NH_4^+). The proportion of the chemical forms in water varies with the physico-chemical properties of the water, particularly pH and temperature. The concentrations of ammonia are usually expressed as either total ammonia (the sum of NH_3 and NH_4^+) which takes into account the total amount as NH_3 or N, or as concentration of the un-ionised NH_3. The concentrations can be given as component of N (e.g., NH_3-N) or total ammonia-N.

The values given below from ANZG (2018) are geometric means of species data taken from all screened data that concurrently measured pH and temperature. Figures were adjusted to a standard pH of 8.0 and calculated in terms of total ammonia nitrogen (total ammonia-N).

Freshwater fish

The 24 – 96 hour LC_{50} values for 15 species were 3,944 to 169,873 μg/L (an anomalous figure of 72 μg/L was extracted from AQUIRE database [1994]). The 6- to 28-d chronic NOEC and EC_{20} (growth and survival) for 9 species were 1,350 to 19,720 μg/L.

Freshwater crustacean

The 24 – 96 hour LC_{50} values for 10 species are 7,754 to 108,500 μg/L. The cladoceran *Simocephalus vetulus* was the most sensitive (24-hour EC and LC_{50} values were approximately 1,580 μg/L), and the amphipod *Crangonyx pseudogracilis* was the least sensitive. The 7-day to 10-week chronic NOEC and EC_{20} values (reproduction) for 4 species are 1,450 to 19,770 μg/L.

Freshwater insects

The 24 – 96 hour LC_{50} values for eight species are 15,091 to 282,400 μg/L. The 29-day chronic NOEC (reproduction) for two species are 1,790 to 4,400 μg/L.

Freshwater molluscs

The acute toxicity for seven species were 12,588 to 74,623 μg/L. The chronic 42- to 60-day NOEC and EC_{20} (reproduction and survival) for two species are 540 to 2,620 μg/L. The most sensitive species under chronic exposure was the New Zealand species *Sphaerium novaezelandiae* with NOEC (60-day mortality and reproduction) of 540 μg/L total ammonia-N.

Freshwater annelid

The 24 – 96 hour LC_{50} values for two species are 20,071 to 79,788 μg/L.

Freshwater rotifer

The 24-hour LC_{50} for *Brachionus rubens* is 1,300 μg/L.

Freshwater Platyhelminthes

The 24 – 96 LC_{50} value for *Polycelus tenuis* is 37,634 µg/L.

C. Terrestrial Toxicity

At 2.1 to 28 mg/m^3, ammonia gas may damage foliage of plants within four hours; damage may occur within 4 to 8 minutes at air concentrations of 175 to 700 mg/m^3 (WHO, 1986; OECD, 2007). Application of ammonium sulfate to soil inhibited onion growth at 399 mg N/kg soil (OECD, 2007).

Frog species *Pseudacris regilla* and *Rana aurora* exposed to ammonium sulfate in the water for 10 days showed no adverse effects at 17.4 to 82.7 mg NH_3-N/L (OECD, 2007). Larvae of the salamander *Ambystoma gracile* showed no effects after 10 days of exposure to 81.5 mg NH_3-N/L (OECD, 2007).

D. Calculation of PNEC

PNEC water

The ANZG water quality guideline (2018) for ammonia in freshwaters is: "A freshwater high reliability trigger value of 900 µg/L TOTAL ammonia-N was calculated at pH 8.0 [emphasis added] using the statistical distribution method with 95% protection. This translates to about 900 µg/L un-ionised ammonia-N at 20°C." See Appendix for information regarding how the guideline figure changes at different pH values.

PNEC sediment

No experimental toxicity data on sediment organisms are available. Octanol/water partition coefficient (K_{ow}) and organic carbon-water partition coefficient (K_{oc}) parameters do not readily apply to inorganics, such as ammonia and the ammonium ion. Thus, the equilibrium partitioning method cannot be used to calculate the $PNEC_{sed}$. Based on its properties, no adsorption of ammonia or the ammonium ion to sediment is to be expected, and the assessment of this compartment will be covered by the aquatic assessment.

PNEC soil

No experimental toxicity data on soil organisms are available. The environmental distribution of ammonia is dominated by its water solubility. Sorption of ammonia and the ammonium ion should probably be regarded as a reversible situation, *i.e.*, the substance is not tightly nor permanently bound. K_{oc} and K_{ow} parameters do not readily apply to inorganics, such as ammonia or the ammonium ion. Thus, the equilibrium partitioning methods cannot be used to calculate the $PNEC_{soil}$. Based on its properties, ammonia and the ammonium ion are not expected to significantly adsorb to soil, and the assessment of this compartment will be covered by the aquatic assessment.

8 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Ammonium hydroxide is a solution of ammonia in water. In water, ammonia is in equilibrium with the ammonium ion (NH_4^+), depending on the pH. Under environmental conditions (pH 5-8), the predominant form will be the ammonium ion (NH_4^+). Ammonia or ammonium ion is rapidly converted to nitrate by nitrification under aerobic conditions in the aquatic environment. Ammonia is part of the nitrogen cycle. Biodegradation is not applicable to ammonia or the ammonium ion. Ammonia (or the ammonium ion) is easily mineralised to the nitrite ion (NO_2^-) by numerous species of bacteria. Therefore, ammonia does not meet the criteria for persistence.

Ammonia is not expected to bioaccumulate in the environment because of its dissociation to the ammonium ion and because it is part of the nitrogen cycles in air, soil and water. Thus, ammonia does not meet the criteria for bioaccumulation.

The chronic NOECs reported in ANZG (2018) for ammonia for aquatic species are greater than 0.1 mg/L, except for a mollusc found in New Zealand. It is unknown whether a similar sensitive species is found in Australia. For the purposes of this risk assessment, the chronic NOECs for ammonia will be considered to be greater than 0.1 mg/L. Acute aquatic toxicity values were greater than 1 mg/L. Thus, ammonia does not meet the screening criteria for toxicity.

The overall conclusion is that ammonia and ammonium hydroxide are not PBT substances.

B. Other Characteristics of Concern

No other characteristics of concern were identified for ammonia or ammonium hydroxide.

9 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Ammonia	7664-41-7	Not a PBT	No	No	NA	No	No	No	2	2	2
Ammonium Hydroxide	1336-21-6	Not a PBT	No	No	NA	No	No	No	2	2	2

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 2 - Hazard Assessment and Qualitative Assessment Only. Develop toxicological profile and PNECs for water and soil and provide qualitative discussion of risk.

Notes:

CAS No. = chemical abstracts service number

COC = chemical of concern

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

10 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
ANZG	Australian and New Zealand Guidelines
AQUIRE	Aquatic Toxicity Information Retrieval
CAS No.	Chemical Abstracts Service Number (also referred to as CAS RN)
COC	chemical of concern
EC_{50}	median effective concentration
ECHA	European Chemicals Agency
EU	European Union
FOB	functional observation battery
g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard
IRIS	Integrated Risk Information System
IUPAC	International Union of Pure and Applied Chemistry
KI	Klimisch scoring system
kPa	kilopascal
LC_{50}	lethal concentration 50%
LD_{50}	lethal dose 50%
mg/kg	milligrams per kilogram

mg/m^3	milligrams per cubic metre
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
OECD	Organisation for Economic Co-operation and Development
Pa	Pascal
PBT	Persistent, Bioaccumulative and Toxic
PNEC	Predicted No Effect Concentration
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
SIDS	Screening Information Dataset
USEPA	United States Environmental Protection Agency
WHO	World Health Organization
µg/L	micrograms per litre

Appendix

Freshwater trigger values as total ammonia-N in µg/L at different pH (temperature is not taken into consideration). Taken from Table 8.3.7 (ANZG, 2018).

pH	Freshwater Trigger value (mg/L as total ammonia-N)	pH	Freshwater Trigger value (mg/L as total ammonia-N)
6.0	2570	7.6	1470
6.1	2555	7.7	1320
6.2	2540	7.8	1180
6.3	2520	7.9	1030
6.4	2490	8.0	900
6.5	2460	8.1	780
6.6	2430	8.2	660
6.7	2380	8.2	560
6.8	2330	8.4	480
6.9	2260	8.4	400
7.0	2180	8.6	340
7.1	2090	8.7	290
7.2	1990	8.8	240
7.3	1880	8.9	210
7.4	1750	9.0	180
7.5	1610	-	-

AMMONIUM CHLORIDE

This dossier on ammonium chloride presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): Ammonium chloride

CAS RN: 12125-02-9

Molecular formula: ClH_4N

Molecular weight: 53.49g/mol

Synonyms: Salmiac; Sal ammoniac; ammonium muriate; ammoniumchlorid; ammonium chloride ($(NH_4)Cl$); ammonium chloride

SMILES: $[NH_4^+].[Cl-]$

II. PHYSICAL AND CHEMICAL PROPERTIES

Table 1: Physico-chemical Properties of ammonium chloride.

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	White crystalline solid	1	ECHA
Melting Point	338°C @ 101.3 kPa	2	ECHA
Boiling Point	Substance is a solid which melt above 300°C and decomposes before boiling.	2	ECHA
Density	1527 kg/m³ @ 20°C	2	ECHA
Vapour Pressure	Not relevant - The melting point is >300°C.	-	ECHA
Partition Coefficient (log K_{ow})	Not relevant - The substance is inorganic.	-	ECHA
Water Solubility	372 g/L at 20°C	2	ECHA
Flash Point	Not relevant - The substance is inorganic solid.	-	ECHA
Auto flammability	Not relevant - The substance is inorganic solid.	-	ECHA
Viscosity	Not relevant - The substance is inorganic solid.	-	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

As an inorganic substance, ammonium chloride is not expected to biodegrade, adsorb to sediments or soil nor is it expected to bioaccumulate to any substantial extent.

B. Biodegradation

The inorganic nature of the material suggests that biodegradation is not applicable for this substance (ECHA).

C. Environmental Distribution

Ammonium chloride is highly soluble in water and soil moisture and is dissociated to the ammonium and chloride ions. Ammonium is bound in soil by the attraction of the positive charge on the ammonium ion to the negatively charged soil micelles. In soil, ammonium is adsorbed primarily by four mechanisms: chemical (exchangeable), fixation (non-exchangeable), reaction with organic matter and physical attractive forces. Since ammonium is so poorly mobile in soil, it is unlikely to leach to groundwater except under unusual circumstances, such as when the cation exchange capacity of the soil is exceeded.

D. Bioaccumulation

Based on the high water solubility and its ionic nature, ammonium chloride is not expected to adsorb or bioaccumulate to a significant extent. Ammonium (ammonia) is a naturally-occurring compound and a key intermediate in the nitrogen cycle. Since it is continually recycled, bioaccumulation, as it is usually considered, does not occur.

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Ammonium chloride is of low toxicity concern.

B. Acute Toxicity

Oral

An OECD Guideline 401 (Acute Oral Toxicity) study was performed. The study was conducted according to a method whose principle is comparable to the OECD Guideline 401. A test group consisting of 10 animals/sex/dose (Sprague Dawley) was treated by single gavage with an aqueous solution of the test substance. Body weights were monitored during the 14-day observation period. The animals were observed for mortality and for clinical signs of toxicity for a period of 14 days. Decedents were subjected to necropsy. At the end of the observation period, the surviving animals were sacrificed (CO_2 asphyxiation) for the purpose of necropsy. The LD_{50} was determined to be 1, 410 mg/kg bw (ECHA) [Kl. Score = 1].

Inhalation

No reliable studies were available.

Dermal

No reliable studies were available.

C. Irritation

Skin

In a dermal study provided in the SIDS Initial Assessment Report For SIAM 17 - Ammonium Chloride (12125-02-9) New Zealand white rabbits were occlusively exposed to 0.5 grams ammonium chloride in 1 mL of water.

For unabraded skin (12 test sites) 7 test sites were scored with a Draize score of 2 while 5 test sites had a Draize score of 3, 24 hours after removal of the test patch. These changes were not observed after 48, 72, 96 hours. No oedema or eschar was found at any observation time point. For abraded (12 test sites; 24-hour observation time point) an erythema score of 2 at 7 sites, and an erythema score of 3 was recorded at 5 sites. These changes were not observed after 48, 72, 96 hours. No oedema or eschar was found at any observation time point (ECHA) [Kl. score = 2].

Eye

In a primary OECD Guideline 405 eye irritation study, the test substance is applied to the conjunctival sac of one eye in 2 Vienna White rabbits. The substance was tested as powder. The animals were observed after 10 min, 1 hour and 3 hours on the day of treatment and up to 8 days afterwards. The eyes were not washed out after 24 hours as specified in OECD Guideline 405.

The results of testing indicated that ammonium chloride can be classified as a Category 2 eye irritant based on GHS criteria (ECHA) [Kl. Score = 2].

D. Sensitisation

A guinea pig maximisation test was performed. Dry powdered ammonium chloride was administered to Pirbright-White (Hoe: DHPK (SPFLac)) guinea pigs. Treated animals displayed no signs of intoxication throughout the entire study duration.

Intradermal injection with Freud's adjuvant (with and without the test substance) led to well defined erythema and slight oedema in control and the treated animals. Very slight to slight oedema appeared at the application sites injected with the test substance in physiological saline (0.9%). Scab formation was noted in all animals. The body weight gain of treated animals was not affected. Only 2 of 10 animals treated with the test substance formulation had a positive reaction. A barely noticeable erythema was seen at the application sites of these animals. The remaining animals showed no irritation effects. The substance was determined to be non-sensitising (ECHA) [Kl. Score = 2].

E. Repeated Dose Toxicity

Oral

An OECD Guideline 408 (Repeated Dose 90-Day Oral Toxicity Study in Rodents) was conducted using male and female Wistar rats. A NOAEL of 1,695.7 mg/kg bw/day was determined based on body weight reduction (ECHA) [Kl. Score = 2].

Inhalation

No adequate or reliable studies are available.

Dermal

No adequate or reliable studies are available.

F. Genotoxicity

In Vitro Studies

An OECD Guideline 471 (Bacterial Reverse Mutation Assay) study was performed. The results of the *in vitro* genotoxicity studies on ammonium chloride are presented in Table 3.

Table 3: *In Vitro* Genotoxicity Studies on ammonium chloride[1]

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay)	-	-	2	ECHA

*+, positive; -, negative

In Vivo Studies

An OECD Guideline 474 (Mammalian Erythrocyte Micronucleus Test) was performed. No signs of general toxicity or bone marrow toxicity were observed in this study. Ammonium chloride did not induce micronuclei in the polychromatic erythrocytes (PCE) of the bone marrow of male rats treated up to 500 mg/kg/day (ECHA) [Kl. Score = 2].

G. Carcinogenicity

Oral

An OECD Guideline 451 was conducted. In a 30-month feedings study, ammonium chloride (> 99.5% pure) was administered in diet continuously to 50 (5-week-old) Wistar rats/sex/dose at two doses: namely 1.0% and 2.1% for a duration of 30 months (ca. 131 weeks). The control group was presented non supplemented diets. No treatment-related abnormalities in condition or behaviour were observed in the rats of this study.

The clinical effects noted were of random nature and corresponded to the usual ageing symptoms seen in this strain of rats. There were also no adverse compound related effects on mortality, food consumption, haematology, clinical chemistry, urinalysis, or organ weights. The type and incidence of palpable masses noted during the chronic studies did not indicate any treatment-related effects. Body weights were significantly reduced at various periods over the 30-month study period in females of the low dose group and both sexes of the high dose group.

Histopathology examinations revealed dose-related increases in the incidence of zona glomerulosa hypertrophy in all treatment groups in both sexes at the end of the 30-month study. Early increases (after 4 and 13 weeks) in zona glomerulosa hypertrophy were also noted with the high (4%) level of NH4Cl. With 2.1% NH4Cl, the incidence of oncocytic tubules was significantly decreased after 30 months. The overall incidence of nephrosis was

comparable among the groups throughout the studies, but after 30 months the incidence of severe nephrosis was decreased in males of the 2.1% NH4Cl group. While a NOAEL for toxicity is 2.1% NH4Cl (1104.6 mg/kg bw), the results of testing were determined to not be treatment related (ECHA) [Kl. Score = 2]. Thus, ammonium chloride is determined to not be carcinogenic.

Inhalation

No studies are available.

H. Reproductive Toxicity

An OECD Guideline 422 (Combined Repeated Dose Toxicity Study with the Reproduction / Developmental Toxicity Screening Test) was performed using Sprague-Dawley rats (ECHA) [Kl. score = 2]. Animals were divided between two subgroups (toxicity and reproductive subgroups). Males of both subgroups and females of the toxicity subgroup were treated until termination during week 6 of treatment. Doses (250, 750 and 1,500 mg/kg/day) were administered to the reproductive subgroup females for two weeks prior to pairing, and throughout pairing and gestation until Day 3 of lactation. Animals that were in parturition at the time of dosing were not dosed that day. Control animals received the vehicle over the same treatment period. Animals were not dosed on their scheduled day of necropsy. A NOAEL of 1500 mg/kg/day for reproduction/developmental toxicity was determined for parental and offspring generations (ECHA) [Kl. Score = 1].

I. Developmental Toxicity

Oral

See reproductive toxicity discussion. A NOAEL of 1500 mg/kg/day for reproduction/ developmental toxicity was determined for parental and offspring generations (ECHA) [Kl. Score = 1].

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

A maximum of 0.5 milligrams ammonia per litre of water has been documented in the Australian Drinking Water Guidelines (ADWG, 2011) for aesthetic considerations. Thus, a drinking water guidance value will not be derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Ammonium chloride does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Ammonium chloride is of low acute and chronic toxicity concern to aquatic and terrestrial receptors. Details of relevant studies are provided below.

B. Aquatic Toxicity

Acute Studies

Species mean acute values (SMAV), were considered as relevant endpoints for the assessment of ammonium chloride toxicity. Table 4 lists the results of acute aquatic toxicity studies on ammonium chloride.

Table 4: Acute Aquatic Toxicity Studies on ammonium chloride.

Test Species	Endpoint	Results (mg/L)[1]	Klimisch score	Reference
Oncorhynchus mykiss	96 hr. LC_{50}	42.91	2	ECHA
Prosopium williamsani	96 hr. LC_{50}	46.27	2	ECHA
Ceriodaphnia acanthina	SMAV[2]	98.5	2	ECHA
Daphnia magna	SMAV[2]	136.6	2	ECHA

1 – tests conducted at pH 8

2 – SMAV = species mean acute value

Chronic Studies

Fish:

Species mean chronic values (SMCV), were considered as relevant endpoints. The lowest species mean chronic value was calculated for *Lepomis macrochirus* (EC20 = 1.35 mg N/L and EC10 = 1.12 mg N/L = 4.28 mg/L ammonium chloride) (ECHA) [Kl. score = 2].

Invertebrates:

The lowest species mean chronic value (EC_{10}, adjusted to pH 8 and 25°C) was 0.66 mg N/L = 2.52 mg/L ammonium chloride for *Hyalella Azteca* (ECHA) [Kl. score = 2].

Aquatic Plants:

In an 18d-long, static test, growth of *Chlorella vulgaris* was inhibited by 50% at approximately 2700 mg/L ammonium sulphate (corresponding to 2186 mg/L ammonium chloride). An EC_{50} (5d) of 1300 mg/L was determined for *Chlorella vulgaris* (ECHA) [Kl Score = 2].

C. Terrestrial Toxicity

Acute toxicity to *Eisenia fetida* was tested in a study according to EPA/600/3-88/029 using ammonium chloride as the test substance (CAS: 12125 -02 -9). The 14d-LC_{50} value was 163 mg/kg soil (ECHA) [Kl Score=2].

D. Calculation of PNEC

In aqueous solution, ammonium chloride is completely dissociated into the ammonium ion (NH4+) and the chloride anion (Cl-). Due to the inorganic nature of the substance standard biodegradation testing systems are not applicable. In unsterilized soil, ammonium chloride is mineralized fairly rapidly, and subsequently nitrified. Nitrification and de-nitrification processes also occur naturally in streams and rivers, as well as in many secondary sewage

treatment processes. Based on the high water solubility and the ionic nature, ammonium chloride is not expected to adsorb or bioaccumulate to a significant extent (ECHA) [KI Score = 2].

Thus, only PNECwater will be derived.

PNEC Water

The PNEC water is derived based on invertebrate toxicity. The lowest species mean chronic value (EC_{10}, adjusted to pH 8 and 25°C) was 2.52 mg/L Ammonium chloride for *Hyalella Azteca.* Applying an assessment factor of 10 yields a $PNEC_{water}$ of 0.25 mg/L.

PNEC Sediment

Based on the dissociation characteristics of the substance, PNECsediment has not been determined.

PNEC Soil

Based on the dissociation characteristics of the substance, PNECsoil has not been determined.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Ammonium chloride is an inorganic substance for which biodegradability is not relevant. Thus, it does not meet the screening criteria for persistence.

Ammonium chloride is an inorganic substance for which bioaccumulation is not relevant. Thus, it does not meet the screening criteria for bioaccumulation.

Ammonium chloride is of low toxicity concern and therefore does not meet the screening criteria for toxicity.

Therefore, ammonium chloride is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Acute Toxicity [Oral] – Category 4

Eye Irritation – Category 2

B. Labelling

Warning

C. Pictogram



X. SAFETY AND HANDLING

A. First Aid

Eye Contact

Immediately flush open eyes with plenty of water for at least 15 minutes. Remove contacts, if present and easy to do. Get medical attention immediately, preferably a physician for an ophthalmologic examination.

Skin Contact

For minor skin contact, avoid spreading material on unaffected skin. Remove and isolate contaminated clothing. Wash the contaminated area of body with soap and fresh water. Get medical attention. Launder contaminated clothing before reuse.

Inhalation

Move person to fresh air. Administer oxygen if breathing is difficult. Do not use mouth-to-mouth method if victim inhaled the substance; give artificial respiration with the air of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Give artificial respiration if victim is not breathing. Get medical attention immediately.

Ingestion

Do not induce vomiting. Get medical attention immediately.

Notes to Physician

All treatments should be based on observed signs and symptoms of distress in the patient.

B. Fire Fighting Information

Extinguishing Media

Use water spray or fog, foam, dry chemical or carbon dioxide.

Specific Exposure Hazards

Emits toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon dioxide, carbon monoxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus and chemical-protective clothing.

C. Accidental Release Measures

Personal Precautions

Isolate area. Keep unnecessary and unprotected personnel from entering the area. Use personal protective clothing. Ensure adequate ventilation. Wear respiratory protection if ventilation is inadequate. Do not breathe mist, vapours or spray. Avoid contact with skin, eyes and clothing. Eliminate all sources of ignition.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

Eliminate all sources of ignition. Pick up with suitable absorbent material and transfer to a container for chemical waste. For large amounts: dike spillage and pump off product into container for chemical waste. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep away from heat, sparks and flame. Avoid contact with eyes, skin and clothing. Avoid breathing vapor. Wash thoroughly after handling. Keep container closed. Use with adequate ventilation.

Storage

Keep container tightly closed. Store away from heat and light.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

Occupational exposure standards have not been established in Australia for ammonium chloride.

Engineering Controls

Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Personal Protection Equipment

Respiratory Protection: If workers are exposed to concentrations above the exposure limit, they must use appropriate, certified respirators. If there are no applicable exposure limit requirements or guidelines, use an approved respirator. Selection of air-purifying or positive pressure supplied-air will depend on the specific operation and the potential airborne concentration of the product. For emergency conditions, use an approved positive-pressure self-contained breathing apparatus. The following should be effective types of air-purifying respirators: organic vapor cartridge with a particulate pre-filter.

Hand Protection: Use gloves chemically resistant to this material. Consult the SDS for appropriate glove barrier materials.

Skin Protection: Use protective clothing chemically resistant to the material. Selection of specific items such as face shield, boots, apron or full body suit will depend on the task.

Eye protection: Use chemical goggles.

Other Precautions: Wash hands, forearms and face thoroughly after handling chemical products, as well as before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Ammonium chloride is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGEMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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AMMONIUM HYDROGEN SULPHITE

This dossier on ammonium hydrogen sulphite presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed ammonium hydrogen sulphite in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to the environment.[1] It is an inorganic substance comprising ions of low ecotoxicological concern. This chemical is not expected to pose an unreasonable risk to the environment provided that ANZECC[2] water quality guidelines for physical and chemical stressors are not exceeded.

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): Ammonium hydrogen sulfite

CAS RN: 10192-30-0

Molecular formula: NH_5SO_3

Molecular weight: 99.1 g/mol

Synonyms: Sulphurous acid, monoammonium salt; ammonium bisulphite; sulphurous acid, ammonium salt (1:1); monoammonium sulphite; ammonium acid sulphite

SMILES: [NH4+].OS(=O)[O-]

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of Ammonium Hydrogen sulphite

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Yellow aqueous solution	2	ECHA
Melting Point	Study technically not feasible	-	ECHA
Boiling Point	Study technically not feasible	-	ECHA
Density	1,373 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	Study technically not feasible	-	ECHA

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=a482433e-f36b-1410-8c14-0026b2c59b62

[2] Water quality guidelines were revised in 2018 are now referred to as Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG)

Property	Value	Klimisch Score	Reference
Partition Coefficient (log K_{ow})	Study technically not feasible	-	ECHA
Water Solubility	2,670 g/L @ 10°C	2	ECHA
Flash Point	Study technically not feasible	-	ECHA
Auto flammability	Study scientifically not necessary	-	ECHA
Viscosity	Study scientifically not necessary	-	ECHA
Henry's Law Constant	Not applicable	-	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Ammonium hydrogen sulphite dissociates into sulphite anions and the respective ammonium cations in aqueous solution or upon contact with soil moisture. Any quantitatively relevant adsorption of ammonium hydrogen sulphite or its dissociation products onto soil, sediments or suspended matter is therefore not expected. Biodegradation is not applicable to inorganic compounds. However, under certain circumstances sulphite substances can be transformed via oxidation by microbial activity. Ammonium is not persistent in water and soil. Ammonium hydrogen sulphite has low potential to bioaccumulate.

B. Biodegradation

Biodegradation testing in water, sediment, and soil was waived as ammonium hydrogen sulphite is an inorganic compound and therefore cannot be subject to biodegradation. However, under certain circumstances sulphite substances can be transformed via oxidation by microbial activity. Ammonium is not persistent in water and soil. Available evidence points to a ready biodegradability of ammonium under aerobic conditions, ultimately becoming part of the global nitrogen cycle (ECHA).

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

Ammonium hydrogen sulphite dissociates into sulphite anions and the respective ammonium cations in aqueous solution or upon contact with soil moisture. Sulphite anions are unstable under environmentally relevant conditions and are readily oxidized to sulphate. Any quantitatively relevant adsorption of ammonium hydrogen sulphite or its dissociation products onto soil, sediments or suspended matter is therefore not expected (ECHA). [Kl. Score = 1].

D. Bioaccumulation

Bioaccumulation testing was waived based on (i) the rapid dissociation of ammonium hydrogen sulphite and decomposition of sulphites and ammonium upon dissolution in environmental solutions, including surface water and sediment porewater, and respective participation in the natural nitrogen and sulphur cycles, (ii) the ubiquitousness of ammonium and inorganic sulphur substances in surface water and sediment as well as their rapid environmental transformation, and

(iii) the essentiality of sulphur in aquatic and terrestrial organisms, ammonium hydrogen sulphite is expected to have a low potential for bioaccumulation in aquatic, sediment and terrestrial organisms (ECHA).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Following oral exposure, sulphites are metabolised by two oxidation routes and studies show that very little, if any, ingested sulphur dioxide (SO_2) is eliminated by exhalation. This material has a low potential for acute oral, inhalation and dermal toxicity. Ammonium hydrogen sulphite was not irritating to the skin and is not predicted to be an eye irritant from *in vitro* models. Read across data demonstrated that the test item was not sensitising and non-genotoxic. Repeated-dose oral studies showed that analogues of ammonium hydrogen sulphite were moderately toxic; however, they were not carcinogens, or reproductive/developmental toxicants.

B. Metabolism

The oxidation of sulphite in human polymorphonuclear leukocytes was investigated, and the sulphite-oxidase catalysed reaction and the non-enzymatic pathway were compared. Two different oxidation routes of sulphite to sulphate were identified. In addition to the pathway via sulphite oxidase another route of oxidation via a one electron oxidation step with an intermediate formation of sulfur trioxide radicals was identified. The contribution of the different pathways is expected to vary substantially due to the great interindividual variation in sulphite oxidase activity. The contribution of the trioxide radical pathway is expected to be high in individuals with low sulphite oxidase activity (ECHA).

The fate of ingested sulphite was investigated in rats using dose levels of 10 and 50 mg SO_2/kg administered as $NaHSO_3$ mixed with Na_2[35]SO_3. Sulphite is readily absorbed from the digestive tract of rats. The studies in rats showed that very little, if any, ingested SO_2 is eliminated by exhalation (ECHA).

C. Acute Toxicity

Oral

In an acute oral toxicity study conducted in accordance with OECD 401 guidelines, male and female Gassner rats were exposed to 200, 1600, 2000, 2250, 2500, 3200, or 6400 mg/kg bw of read-across substance dipotassium disulphite by oral gavage. The LD50 was determined after an observation period of 7 days. All animals in the 6400 mg/kg dose group died within 1 hour. In the 3200 mg/kg dose group, 1/5 male and 3/5 females died within 1 hour and 4/5 males and 5/5 females died within 24 hours. In the 2500 mg/kg dose group 2/5 males and 3/5 females died within 1 hour and 5/5 females died within 24 hours. There were no deaths in the other dose groups. A LD50 >2000 mg/kg bw was found determined for male and female rats after an observation time of 7 days(ECHA). [Kl. Score=2]

In another acute oral toxicity study conducted in accordance with OECD 401 guidelines, male and female Sprague-Dawley rats were exposed to 2150, 2610, or 3160 mg/kg of read-across substance disodium sulphite by oral gavage. All male animals died within 7 days in the 3160 mg/kg dose group, 1 death in the 2610 mg/kg dose group and no deaths in the 2150 mg/kg dose group. All female animals died within 1 day in the 2610 and 3160 mg/kg dose groups. There were no deaths in the

2150 mg/kg dose group. The LD50s for male, female and combined sexes were 2746, >2150 and 2610 mg/kg bw, respectively(ECHA). [Kl. Score=2]

Inhalation

In an acute inhalation toxicity study conducted in accordance with OECD 403 guidelines, male and female Sprague-Dawley rats were exposed nose/head only to 5.5 mg/L of aerosolized read-across disodium sulphite. The exposure was for 4 hours. No mortality occurred in this study. The LC50 was >5,500 mg/m^3 (ECHA). [Kl. Score=2]

Dermal

An acute dermal toxicity study was conducted in accordance with OECD 402 guidelines. Read-across substance disodium sulphite (2000 mg/kg) was applied to the shaved skin of male and female Wistar rats under semiocclusive conditions for 24 hours. The animals were then observed for 14 days for signs of toxicity. No mortality occurred and there was no treatment related clinical observations or pathologic abnormalities. The LD50 was >2000 mg/kg bw (ECHA). [Kl. Score=1]

D. Irritation

Skin

In an acute dermal irritation / corrosion study (OECD 404 guidelines), 70% ammonium hydrogen sulphite was applied to the shaved skin of New Zealand White rabbits under occlusive conditions. The animals were exposed for 4 hours and then observed for up to 72 hours for signs of toxicity. None of the animals showed any signs of skin irritation or oedema. Ammonium bisulphite at 70% was not irritating to the skin (ECHA). [Kl. Score=1]

Eyes

Using an *in vitro* model, the potential for ammonium hydrogen sulphite to cause eye irritation was tested in accordance with OECD 491 guidelines. Samples containing 0.05%, or 5% were incubated with the rabbit corneal cell line for 5 minutes. Following exposure, cell viability was measured using the MTT assay. The cell viabilities were 115.56% and 63.18% following exposure to 0.05% and 5% ammonium hydrogen sulphite, respectively. In conclusion, under the experimental conditions reported, no prediction of the eye irritation potential of ammonium hydrogen sulphite can be made (ECHA). [Kl. Score=1]

E. Sensitisation

Skin

A skin sensitisation study was conducted in accordance with OECD 429. Female NMRI mice were administered 10, 25, or 50% read-across substance sodium metabisulphite to the dorsum of both animal's ears at an application volume of 25 µL/ear. For the next four days, body weight and ear swelling were measured. Animals were observed once daily for any clinical signs of local systemic irritation at the application site or of systemic toxicity. Ear swelling measurements were also carried out immediately before sacrifice. Treatment with sodium metabisulphite at concentrations of 10%, 25% or 50% did not reveal statistical significantly increased values for lymph node cell count, all stimulation indices for the lymph node cell count were beneath the threshold value of 1.4. In

addition, the lymph node weight was not increased. Hence, the test item is classified as not sensitising (ECHA). [Kl. Score=1]

F. Repeated Dose Toxicity

Oral

In a three-generation feeding study, groups of male and female Wistar rats (20 per sex per dose) received 0, 0.125, 0.25, 0.5, 1.0 and 2.0% read-across substance sodium metabisulphite, i.e. 49, 108, 220, 460, and 955 mg/kg bw/d as actual dose in a thiamine-containing diet over periods of 2 years (21 weeks or 34 weeks before mating and up to a total of 104 weeks). All rats in the highest dose group showed indications of occult blood in the feces, while this effect occurred in only 21-60% of the animals on diets containing 1 % sulphite. In 10 % of the females given 0.25 % and in 10 % of the males given 0.5 % sulphite slight indications of intestinal blood loss were observed at wk 32 only. Pathological changes attributable to the feeding of sulphite were observed only in the stomach. - A distinctly raised and thickened limiting ridge and small amounts of a reddish-brown flocky material in the mucus layer of the glandular stomach were seen grossly in the groups given the two highest sulphite levels. Hyperplastic changes were seen in both the forestomach and glandular stomach at the 1.0 and 2.0% sulphite level. They were either present only at the 1 and 2 % dosage levels or their incidence was distinctly increased at these levels. Based on the occurrence of occult blood in the faeces and changes in gastric morphology at dose levels of 0.5% or more, the no observed adverse effect level (NOAEL) for local effects in this study is represented by the dose of 0.25% metabisulphite (or 0.215% accounting for the loss of metabisulphite). The corrected dose level corresponded to a dose of 108 mg/kg bw/d $Na_2S_2O_5$ or an equivalent dose of 72 mg SO_2/kg bw/day. Because there were no evidence of systemic toxicity following chronic treatment, the NOAEL for systemic effects can be expected above the highest dose of 2% metabisulphite corresponding to 955 mg/kg bw/d of $Na_2S_2O_5$ (or 640 mg/kg bw/d as SO_2 equivalents) [Kl. Score=2](ECHA).

Inhalation

In a subchronic inhalation toxicity study, Beagle dogs were exposed continuously to a read-across metabisulphite aerosol of 1 mg/m^3 (equivalent to 0.6 mg/m3 as SO_2) for 290 days. The aerosol was generated from an aqueous 3.5% solution of $Na_2S_2O_5$ adjusted to pH 7. Three dogs served as control. Macroscopic changes were observed in the upper posterior part of the nasal cavity of exposed dogs. Focal thickness of the turbinal wall was observed macroscopically. Histologic changes were observed in the upper posterior part of the nasal cavity of exposed dogs. Histological sections showed that the changes were limited to the respiratory mucosa. The changes were characterized by a thickened epithelial layer resulting from epithelial proliferation, by a decrease in secretory material, and by a moderate mononuclear cell infiltration in the sub-epithelial region. The no observed adverse effect concentration (NOAEC) was not determinable in this study (ECHA). [Kl. Score=2]

Dermal

No data available

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on ammonium hydrogen sulphite and read-across materials are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on ammonium hydrogen sulphite and read-across materials

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial Reverse Mutation Assay (OECD 471)	-	-	1	ECHA
Mammalian Cell Micronucleus Test (OECD 487)	-	-	1	ECHA
Mammalian Chromosome Aberration Test (OECD 473)	-	-	1	ECHA
Mammalian Cell Gene Mutation Test using the Hprt and xprt genes (OECD 476)	-	-	1	ECHA

*+, positive; -, negative

In Vivo Studies

Read-across substance disodium sulphite was tested for chromosomal damage (clastogenicity) and for its ability to induce spindle poison effects (aneugenic activity) in NMRI mice using the micronucleus test method (OECD 474; Mammalian Erythrocyte Micronucleus Test). For this purpose, the test substance, dissolved in purified water, was administered once subcutaneous to male animals at dose levels of 250 mg/kg, 500 mg/kg and 1000 mg/kg body weight in a volume of 10 mL/kg body weight in each case. Purified water was used as the vehicle control, administered by the same route. Cyclophosphamide and vincristine sulphate were used as positive control substances. The animals were sacrificed and the bone marrow of the 2 femora was prepared 24 and 48 hours after administration in the highest dose group of 1 000 mg/kg body weight and in the vehicle controls. In the test groups of 500 mg/kg and 250 mg/kg body weight and in the positive control groups, the 24-hour sacrifice interval was investigated only. After staining of the preparations, 2 000 polychromatic erythrocytes were evaluated per animal and investigated for micronuclei. The normocytes with and without micronuclei occurring per 2 000 polychromatic erythrocytes were also recorded. Under the test conditions, the single subcutaneous administration of disodium sulphite did not lead to any relevant increase in the number of polychromatic erythrocytes containing either small or large micronuclei. The rate of micronuclei was always close to the range as that of the concurrent vehicle control in all dose groups and at all sacrifice intervals and within the range of the historical vehicle control data. The test substance does not have any chromosome damaging (clastogenic) effect, and there were no indications of any impairment of chromosome distribution during mitosis (aneugenic activity) in bone marrow cells in vivo (ECHA). [Kl. Score=1]

H. Carcinogenicity

Oral

In a carcinogenicity test, groups of male and female ICR/JCL mice (50 animals per sex per dose) received 0, 1 or 2% (0, 1500, or 3000 mg/kg bw) read-across substance potassium metabisulphite in the drinking water for 24 months. Exposure was ad libitum. There were no treatment related effects on mortality, body weight, food/water consumption, ophthalmology, haematology, clinical biochemistry or gross pathology. The results of the study suggested that potassium metabisulphite is not carcinogenic in mice. The NOAEL was >3000 mg/kg bw/day (ECHA). [Kl. Score=2]

Inhalation

No data available

Dermal

No data available

I. Reproductive Toxicity

In a three-generation feeding study, groups of male and female Wistar rats (20 per sex per dose) received 0, 0.125, 0.25, 0.5, 1.0 and 2.0% read-across sodium metabisulphite, i.e. 49, 108, 220, 460, and 955 mg/kg bw/d as actual dose in a thiamine-containing diet over periods of 2 years (21 weeks or 34 weeks before mating and up to a total of 104 weeks). All rats in the highest dose group showed indications of occult blood in the feces, while this effect occurred in only 21-60% of the animals on diets containing 1 % sulphite. In 10 % of the females given 0.25 % and in 10 % of the males given 0.5 % sulphite slight indications of intestinal blood loss were observed at wk 32 only. Pathological changes attributable to the feeding of sulphite were observed only in the stomach. - A distinctly raised and thickened limiting ridge and small amounts of a reddish-brown flocky material in the mucus layer of the glandular stomach were seen grossly in the groups given the two highest sulphite levels. Hyperplastic changes were seen in both the forestomach and glandular stomach at the 1.0 and 2.0% sulphite level. They were either present only at the 1 and 2 % dosage levels or their incidence was distinctly increased at these levels. Based on the occurrence of occult blood in the faeces and changes in gastric morphology at dose levels of 0.5% or more, the NOAEL for local effects in this study is represented by the dose of 0.25% metabisulphite (or 0.215% accounting for the loss of metabisulphite). The corrected dose level corresponded to a dose of 108 mg/kg bw/d $Na_2S_2O_5$ or an equivalent dose of 72 mg SO2/kg bw/day. Because there were no evidence of systemic toxicity following chronic treatment, the NOAEL for systemic effects can be expected above the highest dose of 2% metabisulphite corresponding to 955 mg/kg bw/d of $Na_2S_2O_5$ (or 640 mg/kg bw/d as SO2 equivalents) (ECHA). [Kl. Score=2]

J. Developmental Toxicity

Oral

A Prenatal Developmental Toxicity study was conducted in accordance with OECD 414 guidelines, where pregnant hamsters were exposed to 4, 19, 86, or 400 mg/kg bw read-across substance disodium thiosulphate by oral gavage. The animals were exposed daily from day 6 to day 10 gestation and the tested ended on day 14 of gestation. There were no treatment related effects in any of the parameters measured. The survival of pregnant females was not affected by treatment with sodium thiosulphate. Maternal body weights and weight gains were comparable among groups. The pregnancy rates were comparable among groups (control group: 21 pregnant hamsters; 4.0 mg/kg bw/d: 20 pregnant hamsters; 19.0 mg/kg bw/d: 21 pregnant hamsters; 86 mg/kg bw/d: 22 pregnant hamsters; 400 mg/kg bw/d: 20 pregnant hamsters). There were no treatment-related effects on the number of abortions, corpora lutea, implantation sites, live litters and resorptions. The number of live and dead fetuses, sex ratio and average fetal weight was not affected by treatment of dams with sodium thiosulphate. The number of abnormalities seen in either soft or skeletal tissues of the test groups did not differ from the number occurring spontaneously in the sham-treated controls. In conclusion, administration of up to 400 mg/kg bw/d of sodium thiosulphate to pregnant hamsters for 5 consecutive days had no clearly discernible effect on nidation or on maternal or foetal survival. The number of abnormalities seen in either soft or skeletal tissues of the test groups did not differ from the number occurring spontaneously in the sham-treated controls. Thus, the NOAEL for maternal and developmental toxicity can be expected above the highest dose of 400 mg/kg body weight sodium thiosulphate in this hamster study (ECHA). [Kl. Score=2]

Inhalation

No data available

Dermal

No data available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for ammonium hydrogen sulphite follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

The lowest NOAEL from these studies is 400 mg/kg bw/day based on a Prenatal Developmental Toxicity study conducted on hamsters. The NOAEL of 400 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 400/ (10 x 10 x 1 x 10 x 1) = 400/1000 = 0.4 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.4 x 70 x 0.1)/2 = 1.4 mg/L

B. Cancer

Studies conducted in mice did not indicate carcinogenic activity. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Ammonium hydrogen sulphite does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Studies on the aquatic toxicity of ammonium hydrogen sulphite are not available, and thus, read-across to sulphite/disulphite and thiosulphate substances and ammonium cations was conducted. Upon contact with water, salts of sulphur oxyacids including ammonium hydrogen sulphite dissociate into sulphur oxyacid anions and the respective counterions.

Ammonium is a natural component of the environment and found in soil, air, and water. Ammonium is essential for many biological processes, serves as a precursor for amino acid and nucleotide synthesis and provides e.g. a source of nitrogen for plants. Ammonium is produced by bacteria in water and soil from decomposition of organic matter, including plants, animals and animal wastes. Ammonium goes through biochemical transformations in soil and water as part of the nitrogen cycle, is rapidly degraded, i.e. mineralized by numerous species of bacteria, and therefore not expected to accumulate in the environment. Based on the available data, its aquatic and terrestrial toxicity is considered to be low.

B. Aquatic Toxicity

Acute Studies

Studies on the aquatic toxicity of ammonium hydrogen sulphite are not available, and thus, read-across to sulphite/disulphite and thiosulphate substances and ammonium cations was conducted. Upon contact with water, salts of sulphur oxyacids including ammonium hydrogen sulphite dissociate into sulphur oxyacid anions and the respective counterions (ECHA). Table 3 lists the results of acute aquatic toxicity studies conducted on sulphite/disulphite and thiosulphate substances.

Table 3: Acute Aquatic Toxicity Studies on Sulphite/Disulphite and Thiosulphate Substances

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Leuciscus idus (Golden orfe)	96-hr LC_{50}	159.7 (potassium sulphite)	2	ECHA
Leuciscus idus (Golden orfe)	96-hr LC_{50}	200.5 (sodium sulphite)	2	ECHA

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Danio rerio (Zebra fish)	96-hr LC_{50}	490 (potassium metabisulphite)	2	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	>100 (disodium disulphite)	1	ECHA
Raphidocelis subcapitata (Green alga)	72-hr EC_{50}	>84 (growth, disodium disulphite)	1	ECHA

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on sulphite/disulphite and thiosulphate substances.

Table 4: Chronic Aquatic Toxicity Studies on Sulphite/Disulphite and Thiosulphate Substances

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Danio rerio (Zebra fish)	34-day NOEC	200.5 (sodium sulphite)	2	ECHA
Danio rerio (Zebra fish)	35-day NOEC	≥10.5 (survival, sodium dithionite)	1	ECHA
Daphnia magna (Water flea)	21-day NOEC	>8.41 (sodium disulphite)	2	ECHA
Daphnia magna (Water flea)	21-day NOEC	>10 (sodium dithionite)	1	ECHA
Raphidocelis subcapitata (Green alga)	72-hr NOEC	≥84.1 (growth, disodium disulphite)	1	ECHA

C. Terrestrial Toxicity

No reliable studies are available. Taking into account(i) the rapid dissociation of ammonium hydrogen sulphite and decomposition of sulphites and transformation of ammonium upon dissolution in environmental solutions, including soil porewater, and respective participation in the natural nitrogen and sulphur cycle, (ii) ubiquitousness of ammonium and inorganic sulphur substances in soil, (iii) essentiality of sulphur, and (iv) the lack of a potential for bioaccumulation and toxicity to aquatic organisms, the hazard potential of ammonium hydrogen sulphite in soil can be expected to be low (ECHA).

D. Calculation of PNEC

The PNEC calculations for ammonium hydrogen sulphite follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels based on read-across substances. Acute E(L)C_{50} values are available for fish (159.7 mg/L), invertebrates (>100 mg/L), and algae (>84 mg/L). NOEC values from long-term studies are available for fish (>10.5 mg/L), invertebrates (>8.41 mg/L) and algae (>84.1 mg/L). On the basis that the data consists of short-term and long-term results from three trophic levels, an assessment factor of 10 has been applied to the lowest reported NOEC of >8.41 mg/L for invertebrates. The $PNEC_{water}$ is 0.841 mg/L.

PNEC Sediment

No reliable experimental toxicity data on sediment organisms are available. Ammonium hydrogen sulphite dissociates completely in water with its environmental distribution is dominated by its high water solubility. K_{ow} and K_{oc} parameters do not readily apply to inorganics, such as ammonium hydrogen sulphite. Thus, the equilibrium partitioning method cannot be used to calculate the $PNEC_{sediment}$. Based on its properties, no adsorption of ammonium hydrogen sulphite to sediment is to be expected, and the assessment of this compartment will be covered by the aquatic assessment.

PNEC Soil

No reliable experimental toxicity data on terrestrial organisms are available. The environmental distribution of ammonium hydrogen sulphite is dominated by its water solubility. K_{ow} and K_{oc} parameters do not readily apply to inorganics, such as ammonium hydrogen sulphite. Thus, the equilibrium partitioning method cannot be used to calculate the $PNEC_{soil}$. Based on its properties, ammonium hydrogen sulphite is not expected to significantly adsorb to soil, and the assessment of this compartment will be covered by the aquatic assessment.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Ammonium hydrogen sulphite is an inorganic salt that dissociates completely into sulphite anions and the respective ammonium cations in aqueous solution or upon contact with soil moisture. Biodegradation is not applicable to these inorganic ions. For the purposes of this PBT assessment, the persistent criteria are not considered applicable to ammonium hydrogen sulphite or its dissociated ions.

Ammonium hydrogen sulphite dissociates into sulphite anions and the respective ammonium cations in aqueous solution, ions that are ubiquitous in the environment and essential to all living organisms (flora and fauna). Bioaccumulation is thus not expected. As a result, it does not meet the criteria for bioaccumulation.

The NOEC values from chronic aquatic toxicity studies on read-across substances are > 0.1 mg/L. The acute E(L)C_{50} values for are also > 1 mg/L. Thus, ammonium hydrogen sulphite does not meet the criteria for toxicity.

The overall conclusion is that ammonium hydrogen sulphite is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Eye Irritation (Category 2)

B. Labelling

Warning

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

Wash immediately and thoroughly with running water, keeping eyelids raised, for at least 10 minutes. Following this, protect the eyes with sterile gauze or a clean, dry, handkerchief.

Skin Contact

Immediately take off all contaminated clothing. Areas of the body that have or are suspected of having come into contact with the product must be rinsed immediately with plenty of running water and possibly with soap..

Inhalation

Ventilate the premises. The patient is to be removed immediately from the contaminated premises to rest in a well-ventilated area.. Get medical attention.

Ingestion

Induce vomiting. Get medical attention immediately and present SDS. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Avoid inhaling the fumes during combustion.

Special Protective Equipment for Firefighters

Use protection for the respiratory tract.

C. Accidental Release Measures

Personal Precautions

Use gloves and protective clothing. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Limit leakages with earth or sand. If the product has escaped into a water course, into the drainage system, or has contaminated the ground or vegetation, notify the competent authorities.

Steps to be Taken if Material is Released or Spilled

If the product is in a liquid form, stop it from entering the drainage system. Recover the product for re-use if possible, or for elimination. The product might, where appropriate, be absorbed by inert material. After the product has been recovered, rinse the area and materials involved with water..

D. Storage And Handling

General Handling

Avoid contact and inhalation of the vapours. Do not eat or drink while working. Keep away from oxidising agents and acids.

Storage

Keep container tightly closed and in a dry and well-ventilated place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

The workplace exposure standard for ammonium hydrogen sulphite in Australia is as follows: 8.11 mg/m^3.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Use respiratory protection where ventilation is insufficient or exposure is prolonged, e.g. CEN/FFP-2(S) or CEN/FFP-3(S).

Hand Protection: Use protective gloves that provides comprehensive protection, e.g. P.V.C., neoprene or rubber.

Skin Protection: Use clothing that provides comprehensive protection to the skin, e.g. cotton, rubber, PVC or viton.

Eye protection: Use close fitting safety goggles and/or visor conforming to BS 2092 GRADE 1s.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Ammonium hydrogen sulphite is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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AMMONIUM SULFATE

This dossier on ammonium sulfate (also referred to as ammonium sulphate) presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed ammonium sulphate in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to the environment.

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): diazanium sulphate

CAS RN: 7783-20-2

Molecular formula: $H_8N_2O_4S$

Molecular weight: 132.14 g/mol

Synonyms: ammonium sulphate; diammonium sulphate; sulfuric acid diammonium salt; mascagnite

SMILES: [NH4+].[NH4+].[O-]S(=O)(=O)[O-]

II. PHYSICAL AND CHEMICAL PROPERTIES

Table 1: Physico-chemical Properties of Ammonium Sulphate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Odourless white crystalline solid or granules	2	ECHA
Melting Point	> 280°C @ 101.3 kPa	2	ECHA
Boiling Point	Not applicable as substance is solid	1	ECHA
Density	1770 kg/m^3 @ 20°C	2	ECHA
Vapour Pressure	0 Pa @ 25°C	2	ECHA
Partition Coefficient (log K_{ow})	-5.1 @ 25°C	2	ECHA
Water Solubility	767 g/L @ 25°C	2	ECHA
Flash Point	Not applicable as substance is solid	1	ECHA
Auto flammability	Not applicable as substance is solid	1	ECHA
Viscosity	Not applicable as substance is solid	1	ECHA

Property	Value	Klimisch Score	Reference
Dissociation constant (pKa)	9.25 @ 25°C	2	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Ammonium sulphate dissociates in aqueous media to the ammonium ion (NH_4^+) and sulphate anion (SO_4^{2-}). Ammonium sulphate is an inorganic ionic substance that is not expected to adsorb or bioaccumulate. Ammonium sulphate is hydrophilic, and it has high mobility in the soil.

B. Biodegradation

Given the fact the ammonium sulphate is an inorganic substance, biodegradation testing is not applicable.

C. Environmental Distribution

Ammonium sulphate is water soluble so it is mainly expected to partition to aqueous phase. Based on its log K_{ow}, it is not expected to adsorb substantially to the soil phase.

D. Bioaccumulation

No experimental data were available for bioaccumulation or bioconcentration of ammonium sulphate. Based on the high water solubility and the ionic nature, ammonium sulphate is not expected to adsorb or bioaccumulate to a significant extent. In addition, due to the log K_{ow} of –5.1 bioaccumulation is not expected (ECHA).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Ammonium sulphate exhibits low acute toxicity by the oral, inhalation and dermal routes. It is not irritating to the skin and eyes; and it is not a skin sensitiser. In repeated dose toxicity studies, dose-related changes were not observed in rats given ammonium sulphate in feed for 52-weeks. Ammonium sulphate is not genotoxic and is not carcinogenic. No reproductive or developmental effects were observed in read-across studies.

B. Acute Toxicity

<u>Oral</u>

In an OECD Guideline (401) study, Gassner rats were exposed to ammonium sulphate via oral gavage. The LD_{50} was determined to be 4,250 mg/kg bw/day in male and female rats (ECHA) [KI score = 2].

In an OECD Guideline (423 Acute Oral Toxicity) study Wistar rats were exposed to ammonium sulphate via oral gavage. The LD_{50} in rats was determined to be > 2000 mg/kg bw/day (ECHA) [KI score = 2].

Inhalation

In an OECD Guideline 433 (Acute Inhalation Toxicity: Fixed Concentration Procedure) study Sprague-Dawley rats were exposed to ammonium sulphate via nose only aerosol inhalation. The resulting LC_0 was determined to be 3.5 mg/m^3 after 4 hours of exposure (ECHA) [KI score = 2].

Dermal

In an OECD Guideline 434 (Acute Dermal Toxicity) study Wistar rats were exposed to ammonium sulphate via open coverage. The LD50 for this study was determined to be > 2000 mg/kg bw/day (ECHA) [KI score = 2].

C. Irritation

Skin

Vienna White rabbits were exposed to ammonium sulphate for up to 20 hours and they were observed for 8 days. There were no signs of clinical toxicity, so ammonium sulphate is not considered irritating to the skin (ECHA) [KI score = 2].

Eye

Ammonium sulphate was placed on the eyes of Vienna White rabbits without rinsing for 8 days. All of the observed effects were considered reversible, so this substance is not considered an eye irritant (ECHA) [KI score 2].

D. Sensitisation

A guinea pig maximisation test was used to determine if ammonium sulphate is a skin sensitiser. The animals did not show any signs of toxicity throughout the study period. [KI. score = 1]. Ammonium sulphate is not sensitising to the skin of guinea pigs (ECHA) [KI score = 1].

E. Repeated Dose Toxicity

Oral

In an OECD 453 (Combined Chronic Toxicity/Carcinogenicity) study Fischer 344 rats were continuously exposed to ammonium sulphate via their feed for 52weeks.

In the chronic study, groups of 10 rats/sex were fed a diet containing the test substance (purity not given) at concentrations of 0, 0.1, 0.6, or 3% for 1 year. These concentrations corresponded to average daily intakes of 0, 42, 256, and 1527 mg/kg bw/day for males and 0, 48, 284, and 1490 mg/kg bw/day for females, respectively.

No mortality was found in any groups throughout the treatment period. No test substance-related change in the body weights was found. Absolute and relative kidney weights were increased at the high dose level for both sexes. Absolute spleen weights were decreased and relative liver weights were increased in high dose males. No dose-related changes were found in the other organs.

The NOAEL for females was determined to be 284 mg/kg bw/day and the NOAEL for males was determined to be 256 mg/kg bw/day (ECHA) [KI score = 1].

Inhalation

Rats were exposed via whole body inhalation of ammonium sulphate for 8 hours a day over a 14-day treatment period. The NOEC was determined to be 300 mg/m^3 (ECHA) [KI score = 2].

Dermal

No data were available.

F. Genotoxicity

In vitro Studies

The results of the *in vitro* genotoxicity studies on ammonium sulphate based are presented in Table 2.

Table 2: *In Vitro* Genotoxicity Studies on Ammonium Sulphate

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay) S. typhimurium TA 1535, TA 1537, TA 98 and TA 100	-	-	2	ECHA
OECD Guidline 476 (In vitro Mammalian Cell Gene Mutation Test) Chinese hamster lung fibroblasts (V79)	-	-	1	ECHA
OECD Guidline 473 (In vitro Mammalian Chromosome Aberration Test) human lymphocytes	-	-	2	ECHA

*+, positive; -, negative.

In vivo Studies

An *in vivo* mammalian somatic cell study also known as the cytogenicity/erythrocyte micronucleus cell test was conducted using ddY mice exposed to ammonium sulphate. The results showed that ammonium sulphate is not genotoxic to mice as there were no adverse effects observed (ECHA) [KI score = 2].

G. Carcinogenicity

Oral

A chronic oral toxicity and carcinogenicity study was conducted in rats, similar to the requirements of OECD TG 453. For investigation of the carcinogenic potential, groups of 50 rats/sex were fed a diet containing the test substance (purity not given) at concentrations of 0, 1.5, or 3% for 2 years. These concentrations corresponded to average daily intakes of 0,

564.1, and 1288.2 mg/kg bw/day for males and 0, 4649.9, and 1371.4 mg/kg bw/day for females respectively.

No macroscopic changes were recorded by gross pathology, except for massive nodular or focal lesions suggesting neoplastic changes. At histopathological examination, non-neoplastic and neoplastic lesions were noted in the control and treatment groups, with no significant inter-group difference in their incidences or severity.

The authors concluded that the no observed adverse effect level of ammonium sulphate was the 0.6% diet, which is equivalent to 256 and 284 mg/kg bw/d in males and females, respectively, and the compound is noncarcinogenic under the conditions of the study. There was no evidence of a long-term carcinogenic activity of the test substance.

Data on purity of the test substance are lacking; however, since no adverse effects were observed, this is not considered to affect the evaluation of the carcinogenic potential of ammonium sulphate in an adverse manner (ECHA) [Kl. Score = 1].

Inhalation

No studies are available.

Dermal

No studies are available.

H. Reproductive Toxicity

Oral

Read across of data for ammonium phosphate (7783-28-0) was conducted to screen for the reproductive and developmental toxicity effects of ammonium sulphate. A one generation reproductive toxicity study was conducted using Sprague Dawley rats exposed via oral gavage. The NOAEL for reproductive toxicity was determined to be 1500 mg/kg bw/day (ECHA) [KI score = 1].

I. Developmental Toxicity

An OECD Guideline 422 (Combined Repeated Dose Toxicity) study was conducted using Sprague Dawley rats exposed via oral gavage to a read across substance, ammonium phosphate (7783-28-0), for two weeks. A NOAEL could not be established for maternal toxicity based on inflammatory/degenerative stomach changes recorded during histopathological examination. The foetal NOAEL was determined to be 1,500 mg/kg bw/day (ECHA) [Kl. Score = 1].

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for ammonium sulphate follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

The NOAEL from a rat 52-week oral feeding study was reported to be 256 mg/kg bw/day for males based on the actual dose received. This NOAEL will be used for determining the oral reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 1
UF_D (database uncertainty) = 1
Oral RfD = 256/(10 x 10 x 1 x 1 x 1) = 256/100 = 2.56 mg/kg/day.

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2021)
Proportion of water consumed = 10% (ADWG, 2021)
Volume of water consumed = 2L (ADWG, 2021)
Drinking water guidance value = (2.56 x 70 x 0.1)/2 = 8.96 mg/L

B. Cancer

Ammonium sulphate is not considered a carcinogen. Thus, a cancer reference value will not be calculated for this substance.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Ammonium sulphate does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Ammonium sulphate is of low acute concern to aquatic life. Algae is more tolerant than fish or invertebrates.

B. Aquatic Toxicity

In aqueous solution, ammonium salts are completely dissociated into NH_4^+ and a corresponding anion. This equilibrium depends on temperature, pH and ionic strength of the water in the environment. Un-ionized NH_3 species exists in the aquatic environments and the fraction ($NH_3/(NH_3 + NH_4^+)$) steeply increases with elevated pH value or temperature. It is well known that toxicity to aquatic organisms has been attributed to un-ionized ammonia (NH_3) species, and NH_4^+ species is considered to be non- or significantly less-toxic (Emerson et al., 1975 in ECHA). However, recent developments in assessing ammonia toxicity clearly show that in contrast to earlier assumptions where un-ionized ammonia was considered to be the toxic component, both the uncharged and charged molecule are toxic. Therefore, a joint toxicity model has been proposed, with ammonia causing most toxicity at high pH values and ammonium ion also contributing to toxicity at lower pH values (U.S. EPA 1999, OECD 2007 in ECHA).

It is generally accepted, that the principal toxic component of ammonium salts such as ammonium chloride or -sulphate is ammonia, rather than the corresponding anion (see also: OECD 2004, SIDS ammonium chloride or OECD 2007 ammonium sulphate). Therefore, toxicity values for ammonium salts (such as: ammonium -sulphates, phosphates, carbonates, chlorides or nitrates), where the major toxic component is ammonia, can be considered as equivalent, therefore read-across to those substances is possible. Consequently, the aquatic toxicity data compiled for ammonium sulphate comprises the total topic of ammonia toxicity. Species mean chronic values (SMCV) as described in ECHA were considered as relevant endpoints.

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on ammonium sulphate.

Table 3: Acute Aquatic Toxicity Studies on Ammonium Sulfate[1]

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Onchorhyncus mykiss, Salmo gairdneri	96-hour LC_{50} mortality	53	1	ECHA
Prosopium williamsoni	96-hour LC_{50}	57.2	1	ECHA
Ceriodaphnia acanthina	48-hour EC_{50} mobility	121.7	1	ECHA
Daphnia magna	48-hour EC_{50} mobility	169	1	ECHA

1 - Acute toxicity results were normalized to pH 8 and ammonium sulphate.

Chronic Studies

Chronic values were normalized to 25°C. As indicated, plants (algae) are more tolerant than fish or invertebrates to ammonia.

Fish: A 30-day study was conducted to determine the toxicity of ammonium sulphate to *Lepomis macrochirus.* The EC_{10} for ammonium sulphate was determined to be 5.29 mg/L (ECHA) [KI score 1].

Invertebrates: A 10-week study was conducted to determine the toxicity ammonium sulphate to *Hyallella azteca*. The EC_{10} for ammonium sulphate was determined to be 3.12 mg/L based on reproduction (ECHA) [KI score = 1].

Algae: An 18-day study was conducted to determine the toxicity of ammonium sulphate to *Chlorella vulgaris*. The EC_{50} value for ammonium sulphate was determined to be 2,700 mg/L (ECHA) [KI score = 2].

A 5-day study was conducted to determine the toxicity of ammonium sulphate to *Chlorella vulgaris*. The EC_{50} value for ammonium sulphate was determined to be 1,605 mg/L based on the growth rate (ECHA) [KI. Score = 2].

C. Terrestrial Toxicity

No reliable studies available.

D. Calculation of PNEC

The PNEC calculations for ammonium sulphate follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute $E(L)C_{50}$ values are available for fish (53 mg/L) and invertebrates (121.7 mg/L). NOEC values from long-term studies are available for fish (5.29 mg/L), invertebrates (3.12 mg/L) and algae (1,605 mg/L). On the basis that the data consists of short-term results from two trophic levels and long-term results from three trophic levels, an assessment factor of 10 has been applied to the lowest reported EC_{10} value of 3.12 mg/L for invertebrates. Therefore, the $PNEC_{water}$ is 0.312 mg/L.

PNEC Sediment

No reliable experimental toxicity data on sediment organisms are available. Ammonium sulphate dissociates completely in water with its environmental distribution is dominated by its high water solubility. K_{ow} and K_{oc} parameters do not readily apply to inorganics, such as ammonium sulphate. Thus, the equilibrium partitioning method cannot be used to calculate the $PNEC_{sediment}$. Based on its properties, no adsorption of ammonium sulphate to sediment is to be expected, and the assessment of this compartment will be covered by the aquatic assessment.

~~PNEC Soil~~

No reliable experimental toxicity data on terrestrial organisms are available. The environmental distribution of ammonium sulphate is dominated by its water solubility. K_{ow} and K_{oc} parameters do not readily apply to inorganics, such as ammonium sulphate. Thus, the equilibrium partitioning method cannot be used to calculate the $PNEC_{soil}$. Based on its properties, ammonium sulphate is not expected to significantly adsorb to soil, and the assessment of this compartment will be covered by the aquatic assessment.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Ammonium sulphate is an inorganic salt that dissociates completely to ammonium and sulphate ions in aqueous solutions. Biodegradation is not applicable to these inorganic ions. For the purposes of this PBT assessment, the persistent criteria are not considered applicable to ammonium sulphate or its dissociated ions.

The estimated log K_{ow} is for ammonium sulphate is equal to -5.1. This value suggests that ammonium sulphate is not expected to bioaccumulate (ECETOC, 2000). Therefore, ammonium sulphate does not meet the screening criterion for bioaccumulation.

The NOEC or EC10 values from chronic aquatic toxicity studies are > 0.1 mg/L. The acute $E(L)C_{50}$ values for fish and invertebrates are > 1 mg/L. Thus, ammonium sulphate does not meet the criteria for toxicity.

The overall conclusion is that ammonium sulphate is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Acute Toxicity [Oral] – Category 4

Skin Irritation – Category 2

Eye Damage – Category 1

Specific Target Organ Toxicity, Single Exposure [Respiratory] – Category 3

B. Signal word

Warning

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Eye Contact

Immediately flush open eyes with plenty of water for at least 15 minutes. Remove contacts, if present and easy to do. Get medical attention immediately, preferably a physician for an ophthalmologic examination.

Skin Contact

For minor skin contact, avoid spreading material on unaffected skin. Remove and isolate contaminated clothing. Wash the contaminated area of body with soap and fresh water. Get medical attention. Launder contaminated clothing before reuse.

Inhalation

Move person to fresh air. Administer oxygen if breathing is difficult. Do not use mouth-to-mouth method if victim inhaled the substance; give artificial respiration with the air of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Give artificial respiration if victim is not breathing. Get medical attention immediately.

Ingestion

Do not induce vomiting. Get medical attention immediately.

Notes to Physician

All treatments should be based on observed signs and symptoms of distress in the patient.

B. Fire Fighting Information

Extinguishing Media

Use water spray or fog, foam, dry chemical or carbon dioxide.

Specific Exposure Hazards

Emits toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon dioxide, carbon monoxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus and chemical-protective clothing.

C. Accidental Release Measures

Personal Precautions

Isolate area. Keep unnecessary and unprotected personnel from entering the area. Use personal protective clothing. Ensure adequate ventilation. Wear respiratory protection if ventilation is inadequate. Do not breath mist, vapours or spray. Avoid contact with skin, eyes and clothing. Eliminate all sources of ignition.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

Eliminate all sources of ignition. Pick up with suitable absorbent material and transfer to a container for chemical waste. For large amounts: dike spillage and pump off product into container for chemical waste. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep away from heat, sparks and flame. Avoid contact with eyes, skin and clothing. Avoid breathing vapour. Wash thoroughly after handling. Keep container closed. Use with adequate ventilation.

Storage

Keep container tightly closed. Store away from heat and light.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

An occupational exposure standard for ammonium sulphate has not been established in Australia.

Engineering Controls

Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Personal Protection Equipment

Respiratory Protection: If workers are exposed to concentrations above the exposure limit, they must use appropriate, certified respirators. If there are no applicable exposure limit requirements or guidelines, use an approved respirator. Selection of air-purifying or positive pressure supplied-air will depend on the specific operation and the potential airborne concentration of the product. For emergency conditions, use an approved positive-pressure self-contained breathing apparatus. The following should be effective types of air-purifying respirators: organic vapour cartridge with a particulate pre-filter.

Hand Protection: Use gloves chemically resistant to this material. Consult the SDS for appropriate glove barrier materials.

Skin Protection: Use protective clothing chemically resistant to the material. Selection of specific items such as face shield, boots, apron or full body suit will depend on the task.

Eye Protection: Use chemical goggles.

Other Precautions: Wash hands, forearms and face thoroughly after handling chemical products; before eating, smoking and using the lavatory; and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

UN number: 20506 (Solid). This UN number is for ammonium hydrogen sulphate.

XI. DISPOSAL MANAGEMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

Australian Drinking Water Guidelines [ADWG]. (2011). National Water Quality Management Strategy. Australian Drinking Water Guidelines, Section 6, Australian Government, National Health and Medical Research Council, Natural Resource Management Ministerial Council. Updated June 2025. https://www.nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines

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ANIONIC POLYACRYLAMIDE (CAS RN 9003-05-8)
HUMIC ACIDS, SODIUM SALTS, POLYMERS WITH N,N-DIMETHYL-2-PROPENAMIDE, SODIUM 2-METHYL-2-[(1-OXO-2-PROPEN-1-YL)AMINO]-1-PROPANESULFONATE (1:1) AND 2-PROPENENITRILE, SODIUM BISULFITE-TERMINATED (CAS RN 473268-27-8)
HUMIC ACIDS, POTASSIUM SALTS, POLYMERS WITH ACRYLAMIDE, 2-METHYL-2-[(1-OXO-2-PROPENYL)AMINO]-1-PROPANESULFONIC ACID, 4-(1-OXO-2-PROPENYL) MORPHOLINE AND SODIUM 4- ETHENYLBENZENESULFONATE, SODIUM SALTS (CAS RN 227951-37-3)

This group contains a copolymer of acrylamide and acrylic acid and two related complex humic acid/acrylamide copolymers. They are expected to have similar environmental concerns and have consequently been assessed as a group. Information provided in this dossier is based on anionic polyacrylamide (CAS RN 9003-05-8).

This dossier on anionic polyacrylamide and two related complex humic acid/acrylamide copolymers presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. It does not represent an exhaustive or critical review of all available data. The information presented in this dossier was obtained primarily from the Cosmetic Ingredient Review on polyacrylamide (CIR, 2005) and from the book titled *Ecological Assessment of Polymers: Strategies for Product Stewardship and Regulatory Programs* (Lyons and Vasconcellos, 1997). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Anionic polyacrylamide and the two humic acid copolymers are polymers of low concern. Therefore, they are classified as **tier 1** chemicals and require a hazard assessment only.

1 BACKGROUND

Anionic polyacrylamide is the copolymer of acrylamide and acrylic acid. No studies on the environmental fate of polyacrylamide are available. As a high-molecular weight, water-soluble polymer, it is not expected to biodegrade or bioaccumulate. Anionic polyacrylamide has a low acute toxicity concern to aquatic organisms. There is limited evidence to suggest that anionic polyacrylamide also has low chronic toxicity to aquatic organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Copolymer of polyacrylamide (poly(2-propenamide)] and polyacrylate [poly(2-propenoic acid)]

CAS RN: 9003-05-8

Molecular formula: $(C_3H_5NO)_x$- and $(C_3H_3O_2)_x$-

Molecular weight: 1,000,000 to >50,000,000 g/mol for polyacrylamide copolymers used as flocculants (Lyons and Vasconcellos, 1997)

Synonyms: Anionic polyacrylamide

3 PHYSICO-CHEMICAL PROPERTIES

Polyacrylamide polymers can exist in cationic, anionic or non-ionic forms, depending on their ionic charge. The non-ionic form of polyacrylamide is generated from the basic polymerisation of acrylamide. Anionic polyacrylamide polymer can then be formed from the hydrolysis of the acrylamide homopolymer either simultaneously during the polymerisation process or as a subsequent step (Zheng et al., 2013). Anionic polyacrylamide polymer can also be formed from the copolymerisation of acrylamide and acrylic acid (Lyons and Vasconcellos, 1997; Zheng et al., 2013). Polyacrylamide is available in three forms: solid (powder or microbeads), aqueous solutions or inverse solutions (polyacrylamide in water droplets coated with surfactant and suspended in mineral oil; CIR, 2005). Polyacrylamide has a molecular weight range from 8 million to 20 million (CIR, 2005). In general, polymers can vary in chain length, molecular weight, structure or charge, which makes each polymer unique and defined by specific properties (Ecotox Centre, 2019).

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 1). These chemicals are listed on the Australian Inventory of Chemical Substances. No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for these polymers.

NICNAS has assessed each of these polymers in an IMAP Tier 1 assessment and considers each a polymer of low concern.[1] In addition, based on an assessment of environmental hazards, NICNAS also identified anionic polyacrylamide as a chemical of low concern to the environment (DoEE, 2017a). Chemicals of low concern are unlikely to have adverse environmental effects if they are released to the environment from coal seam gas operations.

Table 1 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

No studies on the environmental fate of anionic polyacrylamide are available. As a high-molecular-weight, water-soluble polymer, it is not expected to adsorb (CIR, 2005), biodegrade or bioaccumulate (Lyons and Vasconcellos, 1997). The environmental fate of anionic polyacrylamide will be determined primarily by adsorption (Lyons and Vasconcellos, 1997). Generally, adsorption is increased by increasing molecular weight and polymer chain extension. Cationic polymers are more

[1] https://www.industrialchemicals.gov.au/help-and-guides/polymer-low-concern-plc-criteria

strongly adsorbed to soil (electrostatic interaction with negative particle charge) followed by non-ionic polymers (Van de Waals) and by anionic polymers (cationic bridges). Clay and organic matter present in the soil can also increase adsorption. Adsorption is mostly irreversible, and once the polymers are bound, it is unlikely to desorb, which results in a very low mobility (Ecotox Centre, 2019). Transfer to water is expected to be very low (Ecotox Centre, 2019).

The polyanions in this group are expected to partition onto natural colloids in surface waters and in soil and are not expected to undergo long-range transport in the environment (DoEE, 2017b).

Degradation of this polymer is not expected to lead to the formation of toxic monomers (acrylamide) under normal environmental conditions (Ecotox Centre, 2019). Degradation under environmental conditions in the soil is expected to be influenced by high temperature, sunlight, pH, humidity and salt content and is subject to seasonal variations (Ecotox Centre, 2019).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Anionic polyacrylamide has a low acute toxicity concern to aquatic organisms. However, there is some evidence to suggest that this polymer has low chronic toxicity to aquatic organisms such as crustaceans (Daphnia and algae; Ecotox Centre, 2019).

B. Aquatic Toxicity

Acute Studies

Table 2 lists the results of acute aquatic toxicity studies on the powder form of anionic polyacrylamides. The data were reported in a table as LC_{50} values with no details on the individual studies.

Table 2 Acute Aquatic Toxicity Studies on Anionic Polyacrylamide* in Powder Form

Test Species	Ionic Charge	LC_{50} (mg/L)	Reference
Fathead minnow	-31	810	Betz Laboratories, Inc. (1991)
Rainbow trout	-31	>100	Betz Laboratories, Inc. (1991)
Bluegill sunfish	-31	>300	Betz Laboratories, Inc. (1991)
Rainbow trout	-22	>100	Betz Laboratories, Inc. (1991)
Bluegill sunfish	-22	>300	Betz Laboratories, Inc. (1991)
Rainbow trout	-12	>100	Betz Laboratories, Inc. (1991)
Bluegill sunfish	-12	>300	Betz Laboratories, Inc. (1991)
Daphnia magna	-39	470	Betz Laboratories, Inc. (1991)

*Acrylic acid-acrylamide copolymers with molecular weights of >1,000,000.

Chronic Studies

Limited chronic aquatic toxicity studies are available to evaluate chronic toxicity to aquatic organisms. The aquatic toxicity of anionic polyacrylamide on five tropical freshwater species was reviewed. In available studies, the degree of toxicity was reported as dependent on polymer

characteristics such as polymer chemistry. The authors determined that anionic polyacrylamide impaired the growth of *Hydra viridissima*, EC_{10} = 80–60 mg/L C TOC with stronger negative effects on the reproduction of cladoceran *Moindaphnia macleaya* (EC_{10} = 4 mg/L C TOC). Chronic toxicity on growth was not observed in duckweed and algae and the survival of fish larva. The algae were flocculated, and the locomotion of the fish larva was greatly inhibited (Ecotox Centre, 2019).

C. Terrestrial Toxicity

There are no studies available.

7 CATEGORSIATION AND OTHER CHARACTERISTICS OF CONCERN

D. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Anionic polyacrylamide associated complex humic acid polymers are large molecular weight, water-soluble polymers. They are not expected to be readily biodegradable; thus, they meet the screening criteria for persistence.

Pharmacokinetic studies showed that anionic polyacrylamide was not bioavailable to rats when ingested; this is most likely due to its large size (high molecular weight) and presumed resistance to break down in the gastrointestinal tract. Anionic polyacrylamide and by read-across associated complex humic acid polymers are thus not expected to be bioavailable to aquatic or terrestrial organisms. They are not expected to meet the criteria for bioaccumulation.

Limited chronic aquatic toxicity data are available on anionic polyacrylamide. The acute LC_{50} values in fish and invertebrates are >1 mg/L. Thus, anionic polyacrylamide and by read-across associated complex humic acid polymers do not meet the criteria for toxicity.

The overall conclusion is that anionic polyacrylamide and two related complex humic acid/acrylamide copolymers are not PBT substances.

E. Other Characteristics of Concern

No other characteristics of concern were identified for anionic polyacrylamide and two related complex humic acid/acrylamide copolymers.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment[1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
Anionic Polyacrylamide	9003-05-8	Not a PBT	No	Yes	Yes	No	No	No	1	1	1
Humic acids, potassium salts, polymers with acrylamide, 2-methyl-2-[(1-oxo-2-propenyl)amino]-1-propanesulfonic acid, 4-(1-oxo-2-propenyl) morpholine and sodium 4-ethenylbenzenesulfonate, sodium salts	227951-37-3	Not a PBT	No	Yes	Yes	No	No	No	1	1	1
Humic acids, sodium salts, polymers with N,N-dimethyl-2-propenamide, sodium 2-methyl-2-[(1-oxo-2-propen-1-yl)amino]-1-propanesulfonate (1:1) and 2-propenenitrile, sodium bisulfite-terminated	473268-27-8	Not a PBT	No	Yes	Yes	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

C TOC	total carbon content basis
CAS RN	Chemical Abstracts Service Registry Number
COC	constituent of concern
CIR	Cosmetic Ingredient Review
DoEE	Department of the Environment and Energy
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/mol	gram per mole
IChEMS	Industrial Chemicals Environmental Management Standard
IMAP	Inventory Multi-tiered Assessment and Prioritisation
IUPAC	International Union of Pure and Applied Chemistry
LC	lethal concentration
mg/L	milligram per litre
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals

ASCORBIC ACID

This dossier on ascorbic acid presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed ascorbic acid in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to human health or the environment.[1] [2]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): (5R)-5-[(1S)-1,2-dihydroxyethyl]-3,4-dihydroxy-2,5-dihydrofuran-2-one

CAS RN: 50-81-7

Molecular formula: $C_6H_8O_6$

Molecular weight: 176.12 g/mol

Synonyms: 5-((s)-1,2-dihidroxietil)-3,4-dihidroxifuran-2(5H)-ona; (R)-5-[(S)-1,2-dihidroxietil]-3,4-dihidroxi-5-(H)-furan-2-ona,; L-ascorbate-2-phosphate; (5R)-[(1S)-1,2-dihydroxyethyl]-3,4-dihydroxyfuran-2(5H)-one; L-ascorbic acid; vitamin C; ascorbate

SMILES: OC[C@H](O)[C@H]1OC(=O)C(O)=C1O

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of ascorbic acid

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	White to very pale yellow crystalline powder	-	NCBI, 2026
Melting Point	165°C @ 101.3 kPa	-	USEPA, 2026
Boiling Point	397°C @ 101.3 kPa	-	USEPA, 2026
Density	1650 kg/m^3@ 25°C	-	NCBI, 2026
Vapour Pressure	1.31 x 10^{-8} Pa @ 25°C	-	NCBI, 2026
Partition Coefficient (log K_{ow})	-1.85 (temperature not provided)	-	NCBI, 2026
Water Solubility	>100 g/L @ 22.7°C	-	NCBI, 2026
Flash Point	181°C		USEPA, 2026
Auto flammability	380°C	-	NCBI, 2026

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=ff75433e-f36b-1410-8c14-0026b2c59b62
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=3c4a433e-f36b-1410-8de4-00e8f2afc108

Property	Value	Klimisch Score	Reference
Viscosity	9.98 mPa s @ 25°C	-	USEPA, 2026
Henry's Law Constant	0.000086 Pa m^3/mol (temperature not provided)	-	USEPA, 2026

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Ascorbic acid is readily biodegradable and has a low potential for bioaccumulation. It is not expected to adsorb to soil, suspended solids or sediment.

B. Biodegradation

In a Modified Zahn Wellens test, ascorbic acid exhibited 97% degradation after 5 days (OECD SIDS, 1994).

Using a mixed microbial consortium enriched from untreated sewage samples collected in the vicinity of a primary treatment plant in Delhi, India, ascorbic acid exhibited 36.7 mg/L biological oxygen demand (BOD), suggesting moderate susceptibility to biodegradation (NCBI, 2026).

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

The soil organic carbon partition coefficient (K_{oc}) of ascorbic acid is estimated as 10 L/kg, using a log K_{ow} of -1.85 and a regression-derived equation. This estimated K_{oc} value suggests that ascorbic acid is expected to have very high mobility in soil. The pKa of L-ascorbic acid is 4.70, indicating that this compound will exist almost entirely in the anion form in the environment and anions generally do not adsorb more strongly to soils containing organic carbon and clay than their neutral counterparts (NCBI, 2026).

Likewise, if released to water, formic acid is also not expected to adsorb to suspended solids or sediments.

D. Bioaccumulation

An estimated BCF of 3 was calculated in fish for ascorbic acid, using a log K_{ow} of -1.85 and a regression-derived equation. According to a classification scheme, this BCF suggests the potential for bioaccumulation in aquatic organisms is low (NCBI, 2026).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Following oral exposure, ascorbic acid is expected to passively diffuse across the gastrointestinal tract. Based on high-water solubility and low partition coefficient, ascorbic acid has limited potential for dermal absorption. The material has low / no potential for acute oral toxicity, not a skin or eye irritant and not a sensitiser. Short-term, subchronic and chronic oral toxicity studies demonstrate a

lack of significant systemic toxicity. Ascorbic acid is not genotoxic or carcinogenic. It is not a reproductive / developmental toxicant.

B. Metabolism

Based on its low molecular weight, passive diffusion of the notified chemical across the gastrointestinal tract is likely to occur. However, based on its high-water solubility and low partition coefficient (log Pow = -0.71), dermal absorption may be limited. This is supported by the low dermal penetration rate (2.13% in 8 hours at 32 °C) obtained from an in vitro test (CIR, 2005).

C. Acute Toxicity

The following ascorbic acid LD50s were estimated: mouse >5000 mg/kg bw, rat >5000 mg/kg bw, rabbit >2000 mg/kg bw, cat >1000 mg/kg bw, dog >5000 mg/kg bw, and guinea pig >5000 mg/kg bw (CIR, 2005).

In an acute oral toxicity study, adult albino CD-1 mice fasted 18 h prior to the dosage of 4, 4.5, 5, 5.5, and 7 g/kg bw ascorbic acid. The acute oral LD50 for mice dosed with ascorbic acid was 5.2 ± 0.19 g/kg bw (CIR, 2005).

D. Irritation

Skin

A single application, occlusive patch test was performed in 34 subjects. An occlusive application of a sample containing 20% ascorbic acid (in powder form; unspecified amount) was applied to shaved forearm skin. Patches were removed 0.5, 24, or 48 h after application. After which, the test sites were cleansed and graded using the COLIPA visual scoring method. No erythema, dryness, or oedema was observed at any time point, and no allergic reactions were observed (CIR, 2005).

Eye

In an *In vitro* Ocular Irritation Study, samples containing up to 10% ascorbic acid was evaluated using rabbit corneal epithelial cells in an MTT assay. A statistically significant dose-dependent decrease in cell viability was observed in the cells that were treated for 48 h. However, at the 10% concentration the cell viability of treated cells was 94%, indicating a lack of ocular irritation (CIR, 2005).

E. Sensitisation

No sensitisation data available for ascorbic acid.

A Guinea Pig Maximization Test was conducted with magnesium ascorbyl phosphate, an ascorbic acid analogue. The animals received intradermal and dermal applications with 25% of the test material and challenged with 0, 10, 25, or 50% magnesium ascorbyl phosphate. No signs of irritation were seen after intradermal induction; slight to well-defined erythema was seen in 7/10 test animals after epidermal induction; very small scabs were seen in 2 test animals and 1 control. No sensitisation reactions were attributed (CIR, 2005).

F. Repeated Dose Toxicity

Oral

In a Short-term Oral Toxicity study, mice were administered daily oral doses of ascorbic acid (500 to 1000 mg/kg bw) for seven days. Treated mice showed no difference in appetite, weight gain and general behaviour from controls receiving the same amount of biologically inactive galacturonic acid. Histological examination of various organs (kidney, pancreas, liver, heart, and lungs) showed no changes (CIR, 2005).

In another Short-term Oral Toxicity study, guinea pigs were given ascorbic acid orally in daily doses of 400 to 2500mg/kg bw for 6 days. Again, there were no significant differences between control animals given the same dose of galacturonic acid and treated animals.

Guinea pigs, given ascorbic acid orally in daily doses of 400 to 2500 mg/kg bw for 6 days, showed no difference in appetite, weight gain, or general behaviour from controls receiving the same dose of biologically inactive galaturonic acid. Various organs (kidney, liver, pancreas, heart, and lungs) had no microscopic changes (CIR, 2005).

In a Subchronic Oral Toxicity study, male guinea pigs were exposed to 0, 0.5, or 250 mg ascorbic acid in 0.75 ml water orally for 20 weeks. Control animals were fed only the basal diet and the daily consumption of ascorbic acid from the basal diet was approximately 1.03 to 1.20 mg per animal. Supplementation had no influence on food consumption, growth rate, physical appearance, or behavioural pattern of the guinea pigs. The urinary excretion of ascorbic acid of the treated animals was greater than it was in the control animals. The amount of ascorbic acid excreted in treated animals was 2.5% of the administered dose. The average total glucuronic acid content of the urine of guinea pigs fed 250 mg ascorbic acid per guinea pig per day was similar to that of the control animals. The average 24-h urinary excretion of oxalic acid by guinea pigs fed 250 mg ascorbic acid daily was 3.5 ± 0.8 mg, similar to that of the control animals. Haemoglobin, blood glucose, serum iron, liver iron and liver glycogen of guinea pigs fed 250 mg ascorbic acid was also similar to control values. The authors concluded that large doses of ascorbic acid were neither beneficial nor toxic to guinea pigs (CIR, 2005).

In a Chronic Oral Toxicity Study, ascorbic acid was shown to only exert toxic effects at doses > 25 mg/kg bw when fed to rats. The limiting dose tolerated without symptoms was at least 10 mg/kg bw (CIR, 2005).

Trials with guinea pigs in another Chronic Oral Toxicity Study gave this same threshold. Guinea pigs pretreated with high doses of ascorbic acid survived a scorbutigenic diet and a protein-deficient diet better than control animals receiving only physiological amounts of ascorbic acid with feed (CIR, 2005).

In a third Chronic Oral Toxicity Study, male and female rats (26 animals per sex per dose) received in their diet for two years daily doses of 0, 1000, 1500, or 2000 mg/kg bw of ascorbic acid. Haematological examinations, urine analysis, blood enzyme activity, and liver and renal function tests were within the nor mal range of values observed in the control group. No gross or microscopic detectable toxic lesions were observed which could be attributed to the daily ingestion of large doses of ascorbic acid. Age-dependent degenerative processes in organs, increasing predisposition of aging animals to intercurrent diseases and the appearance of spontaneous tumours occurred at the same rate in control and treated animals. Therefore, the no observed adverse effect level (NOAEL) is 2000 mg/kg bw/day, the highest dose tested (CIR, 2005).

Inhalation

No data available

Dermal

Ascorbic acid was administered in either a stock diet or a scorbutigenic diet and water ad libitum for 10 days to male guinea pigs. Guinea pigs fed the scorbutigenic diet were divided into groups after the 10-day feeding period and were percutaneously given ascorbic acid at doses from 3.5 to 14.0 mg/day in a cream. The cream was applied on the clipped skin of the back just posterior to the neck three times per day. After application the animals were observed. The L-ascorbic acid dose of 7 mg/ day group prevented the development of scurvy. Sixteen hours after the last application of cream, the skin of the back (treated) and of the abdomen (non-treated) were examined microscopically. The applied skin of the backs in the treated groups indicated the existence of ascorbic acid in the intercellular space of the epithelium, contrasting with the absence of ascorbic acid in the control group and in the skin of the abdomen in all groups (CIR, 2005).

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on ascorbic acid are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on ascorbic acid

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
bacterial reverse mutation assay (Salmonella typhimurium and Escherichia coli) (Multiple studies)	-	-	-	CIR, 2005
V79 Chinese hamster cell	+	+	-	CIR, 2005
CHO Cells	+	+	-	CIR, 2005
Mouse lymphoma assay	-	-	-	CIR, 2005
Chromosome Aberration	-	-	-	CIR, 2005
Micronucleus Test	-	-	-	CIR, 2005

*+, positive; -, negative

In Vivo Studies

The *in vivo* genotoxicity studies on ascorbic acid are presented in Table 3.

Table 3: *In vivo* Genotoxicity Studies on ascorbic acid

Test System	Results*	Klimisch Score	Reference
Dominant lethal test in male Wistar rats	-	-	CIR, 2005
Mutagenicity assay of bone marrow in Chinese hamsters	-	-	CIR, 2005
Bone marrow micronucleus assay	-	-	CIR, 2005

*+, positive; -, negative

H. Carcinogenicity

Oral

The Food and Agriculture Organization/World Health Organization (1974) reported no adverse effects on haematological examination or urine analytical measures or liver and renal function tests in rats given daily doses of 1000, 1500, or 2000 mg/kg bw of L-ascorbic acid for 2 years. Gross examination revealed no toxic lesions attributable to L-ascorbic acid (CIR, 2005).

The National Toxicology Program (1983) conducted a 2-year oral carcinogenesis bioassay of ascorbic acid in F344/N rats and B6C3F1 mice. The 25,000 or 50,000 ppm L-ascorbic acid diets were fed to 50 untreated rats and 50 untreated mice of each sex. The animals were observed twice daily for signs of morbidity or mortality, and clinical signs were recorded daily. Necropsies were performed on all animals not autolyzed or cannibalized. Gross and microscopic examinations were performed on major tissues or organs. Under the conditions of this bioassay, ascorbic acid was not carcinogenic for male and female F344/N rats or male and female B6C3F1 mice (CIR, 2005).

Inhalation

No data available

Dermal

No data available

I. Reproductive Toxicity

In a Reproductive Toxicity Study, the potential influence of prolonged exposure of guinea pigs to excessive ascorbic acid on the outcome of pregnancy was examined. This study also examined the adaptive effect of the vitamin either during pre-weanling life or following. Duncan-Hartley guinea pigs were maintained on a stock pellet diet containing 70 mg ascorbic acid/100g, and water was given ad libitum containing either 1 mg or 0.1 mg ascorbic acid/ml. The total intake of ascorbic acid per animal was not recorded. Females in two groups (test and control) were mated. The test groups received extra dietary ascorbic acid in their drinking water each day for two weeks before mating. In treated groups, the pregnant females continued to receive extra ascorbic acid. Following birth three pups were put with one lactating mother, and at 21 days of age, the offspring were separated from their mothers, and the females were put back with males for further mating. These weanlings were divided into two groups: group A was maintained on 1 mg ascorbic acid/ml drinking water, while group B was reduced to 0.1mg/ml during the first 31days of post weanling life. At 31 days these animals were killed. The control animals were also mated, and the offspring were separated from their mothers at 21 days. For four weeks, the offspring were maintained on 1 mg/ml ascorbic acid in the drinking water. The animals were then divided into two groups: group 1 continued 1 mg/ml ascorbic acid for the next 4 weeks, while group 2 received 0.1 mg/ml. At the end of 4 weeks, the animals were killed. All animals became pregnant; no significant difference was observed between the groups, neither in terms of the number of offspring per pregnancy, nor in their weights at birth (CIR, 2005).

J. Developmental Toxicity

Oral

In a Developmental Toxicity Study, ascorbic acid was administered daily oral doses of 150, 250, 500, or 1000 mg/kg to pregnant rats in a first trial from day 6 to day 15 of pregnancy and in a second trial from day 0, preconception, to day 21 postpartum. Also, mice received daily oral doses of 250, 500, or 1000 mg/kg ascorbic acid from day 6 to day 15 of pregnancy. There were no indications of maternal toxicity, terata, or foetal toxicity. There was no effect on the embryonic and postpartum development of the young or on breeding behaviour, pregnancy, parturition, or lactation capacity of the mother animals (CIR, 2005).

In another Developmental Toxicity Study, a group of 30 adult ICR/SIM mice received 3200 mg/kg/day of ascorbic acid in water by oral intubation on days 8 through 12 of gestation. The mice were allowed to deliver, and the neonates were examined, counted, and weighed. Two of the pregnant mice died and their average weight gain was 6.6 ± 2.6 g. Twenty-five litters were born and there was no resorption. The survival rate of the neonates was 99%. The average neonatal weight on day 1 and day 3 was 1.7±0.09 and 2.3±0.2g, respectively. ascorbic acid was considered non-teratogenic in this study (CIR, 2005).

Inhalation

No data available

Dermal

No data available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for ascorbic acid follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

In a 2-year Chronic Oral Toxicity Study conducted on rats, a NOAEL of 2000 mg/kg bw/day was determined. This NOAEL will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

- UF_A (interspecies variability) = 10
- UF_H (intraspecies variability) = 10
- UF_L (LOAEL to NOAEL) = 1
- UF_{Sub} (subchronic to chronic) = 1
- UF_D (database uncertainty) = 1

Oral RfD = 2000/(10 x 10 x 1 x 1 x 1) = 2000 /100 = 20 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (20 x 70 x 0.1)/2 = 70 mg/L

B. Cancer

Ascorbic acid was not carcinogenic on studies conducted in rats and mice. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Ascorbic acid does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Ascorbic acid is a naturally occurring substance and is synthesised in most plants and by many animals. Species which do not naturally synthesise L-ascorbic acid must obtain it in their diet (OECD SIDS, 1994).

Ascorbic acid is expected to have low acute and chronic toxicity to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Limited aquatic toxicity data is available for ascorbic acid. Low toxicity of ascorbic acid would be expected since it is naturally present in many organisms and is an essential vitamin for many species (OECD SIDS, 1994).

Two acute toxicity tests have been carried out with *Oncorynchus mykiss* (rainbow trout). In one test the pH of the test medium was adjusted to pH 7.5 at all ascorbic acid concentrations and in the other test the pH of the test medium was allowed to fall as the concentration of ascorbic acid was increased. In the test carried out at constant pH, no deaths were seen at ascorbic acid concentrations up to the highest tested (1,000 mg/L). A 96-hr LC_{50} value of 1,000 mg/L was therefore

determined. In the test carried out without adjustment of pH, a 96-hr LC_{50} value of 1,020 mg/L was determined. However, no information on the lowering of pH in the test medium with increasing ascorbic acid concentration was provided in the test report. It can be estimated that a concentration of ascorbic acid of 1,000 mg/L will produce a solution of pH around 3.2 and so the validity of the test carried out without adjustment of pH is open to question (OECD SIDS, 1994).

Ascorbic acid is frequently added to the diet of fish reared for food production. No adverse effects were seen in trout fed ascorbic acid in diet at a concentration of 10 g/kg diet over 16 weeks. Similarly, no effects were seen in catfish fed L-ascorbic acid at a concentration of 5 g/kg diet over 150 days (OECD SIDS, 1994).

No data on fish or invertebrates was available.

C. Terrestrial Toxicity

In feeding studies with chickens, no adverse effects were seen at a concentration of 3.3 g/kg diet (OECD SIDS, 1994).

D. Calculation of PNEC

No PNEC values were calculated.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Ascorbic acid is readily biodegradable; thus, it does not meet the screening criteria for persistence.

Ascorbic acid is a naturally occurring substance and is synthesised in most plants and by many animals. The experimental log K_{ow} for ascorbic acid is -1.85 and the estimated BCF is 3 L/kg. Thus, ascorbic acid does not meet the screening criteria for bioaccumulation.

No chronic aquatic toxicity studies and limited acute aquatic toxicity data is available for ascorbic acid. Low toxicity of ascorbic acid would be expected since it is naturally present in many organisms and is an essential vitamin for many species on ascorbic acid are available. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies in fish on ascorbic acid are > 1 mg/L. Thus, ascorbic acid does not meet the criteria for toxicity.

The overall conclusion is that ascorbic acid is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Not classified

B. Labelling

No signal word

C. Pictogram

None identified.

X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control centre. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. Immediately transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

Skin Contact

Immediately flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. If symptoms such as redness or irritation develop, immediately call a physician and be prepared to transport the victim to a hospital for treatment.

Inhalation

Immediately leave the contaminated area; take deep breaths of fresh air. If symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop, call a physician and be prepared to transport the victim to a hospital. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing..

Ingestion

Do not induce vomiting. If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and immediately call a hospital or poison control centre. Be prepared to transport the victim to a hospital if advised by a physician. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on their side with the head lower than the body.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, Halon extinguisher, dry chemical.

Specific Exposure Hazards

Combustible under specific conditions. Gives off irritating or toxic fumes (or gases) in a fire. Finely dispersed particles form explosive mixtures in air..

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

A particulate filter respirator adapted to the airborne concentration of the substance should be worn.

Environmental Precautions

None.

Steps to be Taken if Material is Released or Spilled

If spilled, dampen the solid spill material with water, then transfer the dampened material to a suitable container. Use absorbent paper dampened with water to pick up any remaining material. Seal your contaminated clothing and the absorbent paper in a vapor-tight plastic bag for eventual disposal. Wash all contaminated surfaces with a soap and water solution. Do not re-enter the contaminated area until the Safety Officer (or other responsible person) has verified that the area has been properly cleaned

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Prevent container exposure to air and light. Keep separated from strong oxidants and strong bases. Keep the container tightly closed under an inert atmosphere, and store under refrigerated temperatures.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard has not been established in Australia for ascorbic acid.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Wear self-contained breathing apparatus

Hand Protection: Not specified.

Skin Protection: Not specified.

Eye protection: Safety glasses with side-shields.

F. Transport Information

Ascorbic acid is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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BENZYL ALCOHOL

This dossier on benzyl alcohol presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Benzyl alcohol has been evaluated under the Australian Industrial Chemicals Introduction Schem (AICIS) and has been identified as a chemical that is unlikely to require further regulation to manage risks to the environment.[1]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): phenylmethanol

CAS RN: 100-51-6

Molecular formula: C_7H_8O

Molecular weight: 108.06 g/mol

Synonyms: benzyl alcohol; benzenecarbinol; alpha-hydroxytoluene; benzenemethanol

SMILES: OCC1=CC=CC=C1

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of benzyl alcohol

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Colourless liquid with a slightly aromatic odour	2	ECHA
Melting Point	-15.4°C @ 101.3 kPa	2	ECHA
Boiling Point	205.3°C @ 101.3 kPa	2	ECHA
Density	1045 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	7 Pa @ 20°C	2	ECHA
Partition Coefficient (log K_{ow})	1.05 @ 20°C	2	ECHA
Water Solubility	40 g/L @ 25°C	2	ECHA
Flash Point	100.4°C	2	ECHA
Auto flammability	436°C	2	ECHA

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=4b1079b3-1ab0-ec11-8108-005056a07365

Property	Value	Klimisch Score	Reference
Viscosity	5.84 mPa s @ 20°C	2	ECHA
Henry's Law Constant	0.0879 Pa m^3/mol @ 25°C	2	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Benzyl alcohol is readily biodegradable. It is not expected to bioaccumulate. It is not expected to strongly adsorb to soil or sediment.

B. Biodegradation

Benzyl alcohol is readily biodegradable. In an activated sludge study under aerobic conditions, there was 92 to 96% degradation after 14 days, as determined by oxygen consumption (ECHA) [KI. Score = 2]. In an aerobic study using microorganisms from a treatment plant receiving domestic sewage, there was 95 to 97% degradation after 21 days, as determined by loss of dissolved organic carbon (ECHA) [KI. Score = 2].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

Based on a soil organic carbon partition coefficient (K_{oc}) of 15.7 L/kg, benzyl alcohol is not expected to strongly adsorb to soil or sediment (ECHA).

If released to soil, the substance would be highly mobile. If released to water, based on this K_{oc} value and the substance's water solubility, benzyl alcohol is not expected to adsorb to suspended solids and sediments. Volatilisation from the water column is not expected to be an important fate process based upon a Henry's Law constant of 0.0879 Pa m^3/mol (NCBI, 2026).

D. Bioaccumulation

Based on a log K_{ow} of 1.05, benzyl alcohol has low potential for bioaccumulation (ECHA). This is supported by a low estimated BCF of 1.37 L/kg (ECHA).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Following oral application, benzyl alcohol resorbs quickly and totally from the gastro-intestinal tract and within 6 hours is metabolized and excreted in the urine (75 -85 %). Absorption through occluded skin was high. This material is moderately acutely toxic through oral and inhalation routes. Benzyl alcohol is slightly irritating to the skin and irritating to the eyes. The material is not a skin sensitiser. Repeated dose toxicity did not identify adverse effects via oral and inhalation exposure. It is not a reproductive or developmental toxicant. Benzyl alcohol is not a carcinogen and non-genotoxic.

B. Metabolism

Following oral application of 1.5 g benzyl alcohol, it is resorbed quickly and totally from the gastro-intestinal tract. Within 6 hours it is metabolized and the urinary excreting rate is about 75 -85 % (ECHA) [Kl. Score=2].

Percutaneous absorption was determined in vivo. Absorption through occluded skin was high (56-80 %) in 24 h. No correlation was seen between skin penetration and the octanol-water partition coefficient. Under unoccluded conditions skin penetration was reduced (32 %), because of evaporation of the compound (ECHA) [Kl. Score=2].

C. Acute Toxicity

Oral

In an acute oral toxicity study, 10 male Wistar rats received a single oral application per gavage of 1.0, 1.2, 1.4, 1.5, 2.0 and 2.1 mL benzyl alcohol/kg bw (= 1045, 1254, 1463, 1467, 2090 and 2195 mg/kg bw; density: 1.045 g/mL) and were observed for 14 days. Clinical signs were observed from 1.2 mL/kg bw onwards and included sedation, side and prone position, bloody eyes and reduction of general condition. The resulting LD50 was 1.55 mL/kg bw (= 1620 mg/kg bw) (ECHA) [KI. Score=2].

Inhalation

In a study according to OECD 403 guidelines, groups of 5 young adult Wistar rats/sex were subjected to a single 4-hour head/nose-only exposure to aerosol concentrations of 0 (air control), 3297, and 4178 mg/m³ air and observed for 14 days post exposure. The concentration of 4178 mg/m³ was proven to be the maximum technically achievable concentration. The generated aerosol was respirable for rats. No mortality occurred in the course of the study. Transient clinical signs (piloerection, slight bradypnoea; recovery within 1 day) were seen as causally related to the slight irritant effect of the test article to the upper respiratory tract (reflex bradypnoea caused by sensory irritation). No indication of respiratory damaging property was found in this study. Therefore, the LC50 (4h) was concluded to be > 4178 mg/m³ air for male and female rats. No effects were noted at 3297 mg/m³ air (ECHA) [Kl. Score=1].

Dermal

No data available

D. Irritation

Skin

In a study for skin irritation/corrosion (OECD 404 guidelines), New Zealand White rabbits were administered neat benzyl alcohol samples to the shave skin for 4 hours under semiocclusive conditions. After exposure, the animals were observed for 7 days for signs of toxicity. Benzyl alcohol showed only slight effects to the skin in one animal (exposure period: 4 hours, 2 rabbits without any irritant effects, 1 rabbit with erythema score 1 at maximum, fully resolved within 72 hours) (ECHA) [Kl. Score=1].

Eye

An acute eye irritation / corrosion study was conducted in accordance with OECD 405 guidelines. New Zealand White rabbits received a dose of 100 µl/animal into the conjunctival sac of one eye of each rabbit (the untreated eye served as control). Eyes were washed out 24 hours after start of exposure. The total post exposure period was 21 days. Benzyl alcohol was irritating to the eyes of rabbits, but full recovery occurred within the 21 days observation period (ECHA) [Kl. Score=1].

E. Sensitisation

In a Local Lymph Node Assay (OECD 429), female CBA/Ca/Ola/Hsd-mice received applications of pure benzyl alcohol at 2.5, 5, 10, 25 or 50%. In this study, there were no 3 -fold increase in lymphocytes after substance application at concentrations of 2.5, 5, 10, 25, and 50 % and thus no indication for a sensitising potential of the substance. Hexyl cinnamaldehyde as positive control showed the expected positive result after application of a 10 or 25 % formulation in acetone:olive oil 4:1, confirming thus the validity of the protocol used for this study (ECHA) [Kl. Score=1].

F. Repeated Dose Toxicity

Oral

In a study equivalent to OECD 451 guidelines, male and female F344/N rats received daily by gavage 0, 200 and 400 mg/kg bw/day benzyl alcohol diluted in corn oil for 104 weeks (5 days/week). No effect on body weight gain and no compound-related clinical signs was observed throughout the study. Survival was reduced only for female rats, but in many cases, deaths were attributed the gavage procedure. Gross necropsy and histopathology revealed no apparent compound-related non-neoplastic responses. Thus, 400 mg/kg can be considered a no observed adverse effect level (NOAEL) from this study (ECHA) [Kl. Score=2].

Inhalation

In Subacute Inhalation Toxicity Study (OECD 412), aerosolized benzyl alcohol was administered via nose-only inhalation for 6 hours per day on a 5-day/week basis for a period of 4 weeks (a minimum of 20 exposures/animal) to 4 groups (Groups 2-5) of Sprague-Dawley rats. Target exposure concentrations were 30, 100, 300, and 1000 mg/m³ for Groups 2, 3, 4, and 5, respectively. A concurrent control group (Group 1) was exposed to filtered air on a comparable regimen. Each group consisted of 10 animals/sex. All animals were euthanized on the day following the last exposure. Based on the results of this study, repeated inhalation exposure of male and female rats to benzyl alcohol at mean analytical concentrations of 41, 102, 290 and 1072 mg/m³ was well-tolerated with no adverse effects at any exposure concentration. The no-observed-adverse-effect concentration (NOAEC) was 1072 mg/m³ (ECHA) [Kl. Score=1].

Dermal

No data available

G. Genotoxicity

Benzyl alcohol is not considered genotoxic based on *in vitro* and *in vivo* studies (ECHA).

In Vitro Studies

The *in vitro* genotoxicity studies on benzyl alcohol are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on Benzyl Alcohol

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay)	-	-	2	ECHA
OECD Guideline 476 (In Vitro Mammalian Cell Gene Mutation Test)	+	-	2	ECHA
Sister chromatid exchange assay in mammalian cells (Chinese Hamster Ovary [CHO])	**	**	2	ECHA
OECD Guideline 473 (In Vitro Mammalian Chromosome Aberration Test) (CHO)	-	+ (weak)	2	ECHA
OECD Guideline 487 (In vitro Mammalian Cell Micronucleus Test)	-	-	2	ECHA

*+, positive; -, negative

** *"A dose-related increase was observed in the sister chromatid exchange (SCE) assay in Chinese hamster ovary (CHO) cells in one of two trials conducted in both the presence and absence of metabolic activation. This response was considered weakly positive because the increase in SCEs was significantly elevated over the control only at the highest dose level. The overall result of the test was concluded to be equivocal because the weak positive response obtained was not reproduced."*

In Vivo Studies

In a Mammalian Erythrocyte Micronucleus Test (OECD 474), benzyl alcohol did not induce an increased number of micronuclei in polychromatic erythrocytes of the bone marrow of mice after repeated i.p. administration (4 x 100 mg/kg bw) at 24 -hour intervals (ECHA) [Kl. Score=2].

H. Carcinogenicity

Oral

A Carcinogenicity Study was conducted in accordance with OECD 451 guidelines. Male and female F344/N rats received daily by gavage 0, 200 and 400 mg/kg bw/day benzyl alcohol diluted in corn oil for 104 weeks (5 days/week). Under the conditions of the 2-year gavage study, there was no evidence of carcinogenic activity of benzyl alcohol for male or female F344/N rats dosed with 200 or 400 mg/kg. Survival in both dose groups of female rats was 50% that of vehicle controls, primarily due to an increased number of gavage-related deaths (ECHA) [Kl. Score=1].

Inhalation

No data available

Dermal

No data available

I. Reproductive Toxicity

In a 13-week oral exposure study, male and female Fischer 344 rats received once daily on 5 days/week 0, 50, 100, 200, 400, 800 mg/kg bw benzyl alcohol via gavage. Based on clinical signs and reduced body weight development in males and females and histopathological changes in the brain at 800 mg/kg bw, the NOAEL was established as 400 mg/kg bw/day. Regarding reproductive organs no compound related effects could be found (gross and histopathologic examination) (ECHA) [Kl. Score=2].

J. Developmental Toxicity

Oral

In a Developmental Toxicity Study, benzyl alcohol was administered by gavage at a dose of 750 mg/kg bw per day to 50 CD-1 mice on days 7-14 of gestation; evidence of copulation was considered the first day of gestation. A control group of 50 animals received distilled water only. All animals were allowed to deliver their litters and nurse their pups for three days, at which time necropsies were performed. Maternal body-weight gain and mortality, mating, gestation, numbers of live and dead pups per litter, total litter weight on days 1 and 2 postpartum, litter weight change between days 1 and 3 postpartum, and pup survival on days 1 and 3 post-partum were recorded. During the treatment period, 18 deaths were reported, all of which were attributed to treatment; a further death was reported on day 15 of gestation, the day after treatment was terminated. Clinical signs of toxicity, including hunched posture, tremors, inactivity, prostration, hypothermia, ataxia, dyspnoea, swollen or cyanotic abdomen, and piloerection, were reported in up to 20 mice during treatment. Piloerection was also reported in some animals up to day 3 postpartum, but no other clinical signs were seen after the period of administration. No differences were observed in the mating or gestation indices, the total number of resorptions, the mean length of gestation, or the number of live pups per litter between treated and control groups. Maternal body weight, measured on days 4 and 7 of gestation, was not significantly different from control values; however, statistically significant reductions were reported on day 18 of gestation ($P < 0.001$) and on day 3 postpartum ($P < 0.05$). Maternal body weight gain during days 7-18 of gestation was significantly lower than that of controls ($P < 0.001$). Significant reductions in pup body weight were reported, including a lower mean pup weight per litter on days 1 ($P < 0.01$) and 3 postpartum ($P < 0.001$), a mean litter weight change between day 1 and day 3 postpartum ($P < 0.05$), and a mean pup weight change between days 1 and 3 postpartum ($P < 0.001$). No differences in pup survival were observed by day 3 postpartum. The authors concluded that benzyl alcohol may be a reproductive hazard, apparently based on the reductions in pup body weights, an effect that was observed in conjunction with maternal toxicity evidenced by increased mortality, reduced body weights, and clinical toxicity during the period of administration. As effects were seen on the dams and foetuses at the only dose used in this study, there was no NOAEL and LOAEL was 750 mg/kg bw per day (ECHA) [Kl. Score=2].

Inhalation

No data available

Dermal

No data available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for benzyl alcohol follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

The lowest NOAEL from these studies is 400 mg/kg bw/day based on the combined two-year repeat dose oral chronic toxicity/carcinogenicity study conducted on rats. The NOAEL of 400 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 1
UF_D (database uncertainty) = 1
Oral RfD = 400 /(10 x 10 x 1 x 1 x 1) = 400/100 = 4 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (4 x 70 x 0.1)/2 = 14 mg/L

B. Cancer

Benzyl alcohol does not have carcinogenic potential. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Benzyl alcohol does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Benzyl alcohol is expected to have low acute and chronic toxicity to aquatic organisms. No studies are available for terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on benzyl alcohol.

Table 3: Acute Aquatic Toxicity Studies on Benzyl Alcohol

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Oryzias latipes (Japanese rice fish)	96-hr LC_{50}	≥100	1	ECHA
Pimephales promelas (Fathead minnow fish)	96-hr LC_{50}	460	2	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	230	1	ECHA
Daphnia magna (Water flea)	24-hr EC_{50}	55	2	OECD
Raphidocelis subcapitata (Green algae)	72-hr EC_{50}	759 (growth)	1	ECHA

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on benzyl alcohol.

Table 4: Chronic Aquatic Toxicity Studies on Benzyl Alcohol

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Daphnia magna (Water flea)	21-day NOEC	51	1	ECHA
Raphidocelis subcapitata (Green algae)	72-hr NOEC	556 (growth)	1	ECHA

C. Terrestrial Toxicity

No studies available. Direct and indirect exposure of the soil compartment is unlikely (ECHA).

D. Calculation of PNEC

The PNEC calculations for benzyl alcohol follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (≥100 mg/L), invertebrates (55 mg/L), and algae (759 mg/L). NOEC values from long-term studies are available for invertebrates (51 mg/L) and algae (556 mg/L). On the basis that the data consists of short-term results from three trophic levels and long-term results from two trophic levels, an assessment factor of 50 has been applied to the lowest reported NOEC of 51 mg/L for invertebrates. The $PNEC_{water}$ is 1.02 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 0.88 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (1.10/1280) \times 1000 \times 1.02$
$= 0.88$ mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 0.628/1000 \times 2400]$
$= 1.10\ m^3/m^3$

Where:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
$= 15.7 \times 0.04$
$= 0.628$ L/kg

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for benzyl alcohol calculated from EPISUITE™ using the MCI is 15.7 L/kg.
F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are no toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 0.21 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
$= (0.314/1500) \times 1000 \times 1.02$
$= 0.21$ mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
$Kp_{soil} = K_{oc} \times f_{oc}$
$= 15.7 \times 0.02$
$= 0.314\ m^3/m^3$

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for benzyl alcohol calculated from EPISUITE™ using the MCI is 15.7 L/kg.
F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Benzyl alcohol is readily biodegradable and thus does not meet the screening criteria for persistence.

Based on a log K_{ow} of 1.05, benzyl alcohol does not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on benzyl alcohol are > 0.1 mg/L in invertebrates and algae. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies on benzyl alcohol are > 1 mg/L in fish, invertebrates and algae. Thus, benzyl alcohol does not meet the criteria for toxicity.

The overall conclusion is that benzyl alcohol is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Acute Toxicity Category 4, H302

Eye Irritation Category 2A, H319

Skin Sens. Category 1B, H317

B. Labelling

Warning

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses if possible. Seek medical attention.

Skin Contact

Immediately flood affected skin with water while removing and isolating all contaminated clothing. Remove contaminated clothes. Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink one or two glasses of water to dilute the chemical. Immediately call a hospital or poison control centre. Do not induce vomiting. Transport victim to a hospital. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas. Store in a stainless-steel tank because benzyl alcohol oxidizes readily.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place with the temperature not exceeding 40°C.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard in Australia for benzyl alcohol is not listed.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Benzyl alcohol is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Important considerations include impact on air quality, potential migration in soil or water, and effects on animal and plant life. Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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BISPHENOL A/EPICHLOROHYDRIN RESIN

This dossier on bisphenol A/epichlorohydrin resin presents the most critical studies pertinent to the risk assessment of this substance in its use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA) and a National Industrial Chemicals Notification and Assessment Scheme (NICNAS) Inventory Multi-tiered Assessment and Prioritisation (IMAP) Group Assessment Report (NICNAS, 2015). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Bisphenol A/epichlorohydrin resin was not identified in chemical databases used by NICNAS as an indicator that the chemical is of concern and is not a PBT substance. Bisphenol A/epichlorohydrin resin was assessed as a tier 2 chemical for acute and chronic toxicity. Therefore, this substance is classified overall as a **tier 2** chemical and requires a hazard assessment and qualitative assessment of risk.

1 BACKGROUND

Bisphenol A/epichlorohydrin resin and similar epoxy resins have reported commercial uses as binders, coating agents, plating agents, adhesives, sealants, intermediates, lubricant additives, corrosion inhibitors, anti-scaling agents, and processing aids.

Bisphenol A/epichlorohydrin resin is not readily biodegradable. It is expected to be hydrolytically unstable under environmental conditions. Hydrolysis products have a low potential to adsorb to soil. However, due to their low solubility in water they will likely adsorb to dissolved organic matter and settle onto sediments. It is not expected to bioaccumulate.

Limited data is available for bisphenol A/epichlorohydrin resin. Therefore, the hazard assessment is supported by information obtained from read-across monomer BADGE (CAS RN 1675-54-3).

BADGE is rapidly absorbed after ingestion but slowly absorbed through the skin. Bisphenol A/epichlorohydrin resin and read-across substance BADGE have low acute oral and dermal toxicity potential. Bisphenol A/epichlorohydrin resin is not classified as a skin and eye irritant. However, bisphenol A/epichlorohydrin resin has been identified as a skin sensitiser in humans. BADGE has shown low toxicity at low repeated doses and is not considered to be genotoxic based on *in vivo* studies. Insufficient evidence of carcinogenicity exists. Neither substance is a reproductive or developmental toxicant.

The acute and chronic toxicity of bisphenol A/epichlorohydrin resin is of moderate concern to aquatic organisms. No studies are available for terrestrial organisms. However, it is expected to have low toxicity to sediment-dwelling organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Phenol, 4,4'-(1-methylethylidene)bis-, polymer with 2-(chloromethyl)oxirane

CAS RN: 25068-38-6

Molecular formula: $(C_{15}H_{16}O_2.C_3H_5ClO)_x$ (UVCB substance)

Molecular weight: 350-370 g/mol (NAMW)

Synonyms: bisphenol A/epichlorohydrin resin; 4,4'-(methylethylidene) bisphenol polymer with (chloromethyl)oxirane; 4,4'-Isopropylidenediphenol, oligomeric reaction products with 1-chloro-2,3-epoxypropane; bisphenol A diglycidyl ether, epoxy resin; 2-(chloromethyl)oxirane; bisphenol A-epoxy resin

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of bisphenol A/epichlorohydrin resin

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Highly viscous liquid	1	ECHA
Melting Point	Not determinable, decomposes at 300 °C	1	ECHA
Boiling Point	Not determinable, decomposes at 300 °C	1	ECHA
Density	1180 kg/m³ @ 20 °C	1	ECHA
Vapor Pressure	2.4E-07 Pa @ 20°C	1	ECHA
Partition Coefficient (log K_{ow})	3.6 @ 35°C	1	ECHA
Water Solubility	0.000141 g/L @ 20°C	1	ECHA
Dissociation constant (pKa)	Not available	-	ECHA
Viscosity	Not available	-	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for bisphenol A/epichlorohydrin resin.

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No

Convention, Protocol or other international control	Listed Yes or No?
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Bisphenol A/epichlorohydrin resin is not readily biodegradable. It is expected to be hydrolytically unstable under environmental conditions. Hydrolysis products have a low potential to adsorb to soil. However, due to their low solubility in water they will likely adsorb to dissolved organic matter and settle onto sediments. It is not expected to bioaccumulate.

B. Partitioning

Bisphenol A/epichlorohydrin resin is expected to be hydrolytically unstable under environmental conditions. Members of the resin group diglycidyl ether of bisphenol A (DGEBA) are susceptible to hydrolysis and the hydrolysis products are not expected to volatilise into the air compartment as they have low expected Henry's Law constant (1.67×10^{-9} Pa-m^3/mol) (Health Canada, 2019).

C. Biodegradation

No experimental data are available for bisphenol A/epichlorohydrin resin. In an OECD Guideline 301 F (Ready Biodegradability: Manometric Respirometry Test) on read-across substance monomer bisphenol A diglycidyl ether (BADGE) (CAS RN 1675-54-3), degradation after 28 days was approximately 5% as measured by oxygen consumption (ECHA) [KI. Score = 1]. As result, the substance is not readily biodegradable.

If a chemical is found to be not readily biodegradable, it is categorised as Persistent since its half-life is substantially greater than 60 days (DoEE, 2017).

D. Environmental Distribution

No experimental data are available for bisphenol A/epichlorohydrin resin. Based on an estimated log soil organic carbon partition coefficient (K_{oc}) value of 1.28 L/kg (K_{oc} value of 19 L/kg) for the hydrolysis product, if released to soil, the substance is expected to have low potential to adsorb to soil. If released to water, with its limited solubility (0.096 g/L), the hydrolysis product is likely to adsorb to dissolved organic matter in the water column and settle onto sediments (Health Canda, 2019).

E. Bioaccumulation

Based on a low log K_{ow} of 3.6 and measured bioconcentration factor (BCF) range of 0.56 to 31, bisphenol A/epichlorohydrin resin has a low potential for bioaccumulation (Health Canada, 2019).

6 HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Limited data is available for bisphenol A/epichlorohydrin resin. Therefore, the human health hazard assessment is supported by information obtained from read-across monomer BADGE (CAS RN 1675-54-3). BADGE is rapidly absorbed after ingestion but slowly absorbed through the skin. Bisphenol A/epichlorohydrin resin and read-across substance BADGE have low acute oral and dermal toxicity potential. Bisphenol A/epichlorohydrin resin is not classified as a skin and eye irritant. However, bisphenol A/epichlorohydrin resin has been identified as a skin sensitiser in humans. BADGE has shown low toxicity at low repeated doses and is not considered to be genotoxic based on *in vivo* studies. Insufficient evidence of carcinogenicity exists. Neither substance is a reproductive or developmental toxicant.

B. Toxicokinetics

No metabolic studies are available for bisphenol A/epichlorohydrin resin. It is expected to undergo similar metabolism to BADGE (CAS RN 1675-54-3). BADGE is rapidly absorbed after ingestion but slowly absorbed through the skin. The main metabolic pathway is rapid hydrolysis by epoxide hydrolase to form the bis-diol form of the chemical, which is the main metabolite found in the urine. Further metabolic breakdown includes oxidation of the diol group to a hydroxycarboxylic acid, and partial subsequent decarboxylation, to produce the main faecal metabolite identity. The formation of bisphenol A (BPA) (CAS RN 80-05-7) was not observed in any of the metabolic studies of BADGE. This is consistent with the stability of ether linkages (NICNAS, 2015).

C. Acute Toxicity

Oral

An acute oral toxicity study was conducted on bisphenol A/epichlorohydrin resin in accordance with OECD 423 guidelines. Female Wistar Han rats were administered 2,000 – 5,000 mg/kg bw of the test substance by oral gavage. No treatment-related abnormalities were found at macroscopic post mortem examination of the animals. One animal showed reddish foci on the thymus, which is more often seen in rats of this strain in these kinds of studies. Therefore, this was considered not related to treatment with the test material. The LD_{50} for acute oral toxicity was >5,000 mg/kg bw (ECHA). [KI score = 1]

An oral LD_{50} value of 19,600 mg/kg bw was reported in rats; 19,800 mg/kg bw in male rabbits; and >15,000 mg/kg bw in male Long Evans rats (NICNAS, 2015).

Dermal

For bisphenol A/epichlorohydrin resin, the dermal LD_{50} was 2,000 mg/kg bw in Wistar rats and 23,032 mg/kg bw (calculated from the actual dose of 20 mL/kg bw) in male New Zealand White rabbits (NICNAS, 2015).

Inhalation

No information is available for BADGE resin (NICNAS, 2015).

D. Irritation

Skin

In an OECD Guideline 439 (*In Vitro* Skin Irritation: Reconstructed Human Epidermis Test Method) study, bisphenol A/epichlorohydrin resin was applied directly on top of the skin tissue for 42 ± 1 minutes. The relative mean tissue viability compared to the negative control tissues was 86%. Since the mean relative tissue viability for the test material was above 50% after 42 ± 1 minutes treatment bisphenol A/epichlorohydrin resin is considered to be non-irritant (ECHA). [Kl. Score = 1]

In an OECD Guideline 431 (*In Vitro* Skin Corrosion: Reconstructed Human Epidermis (RHE) Test Method) study, the corrosive potential of bisphenol A/epichlorohydrin was tested through topical application for 3 minutes and 1 hour. The relative mean tissue viability obtained after 3-minute and 1-hour treatments compared to the negative control tissues was 98% and 84%, respectively. Since the mean relative tissue viability was >50% after the 3-minute treatment and >15% after the 1-hour treatment, bisphenol A/epichlorohydrin is considered to be not corrosive (ECHA). [KI score=1]

In a study in three New Zealand White rabbits, 0.6 mL of undiluted bisphenol A/epichlorohydrin resin (average molecular weight <700 g/mol) was applied to shaved skin occlusively for four hours. The animals were observed after 1, 24, 48, 72 hours and seven and 14 days post-application. Slight erythema was observed. The average irritation score after 24, 48, and 72 hours was 0.7. The effects were reversed within seven days (NICNAS, 2015).

Eyes

An eye irritation study was conducted in accordance with OECD 492B guidelines. Bisphenol A/epichlorohydrin resin was topically applied on the Reconstructed Human Cornea-like Epithelium (RHCE) Model. Eye hazard potential is expressed as the remaining cell viability after exposure to the test material. The relative mean tissue viability obtained after the 30-minute and 120-minute treatments was 105% and 100%, respectively. Since the mean relative tissue viability was >40% after 30 minutes treatment and >60% after 120 minutes treatment, bisphenol A/epichlorohydrin resin is not considered to be an eye irritant (ECHA). [KI score=1]

In an experiment conducted in three New Zealand White rabbits, a single dose of 0.1 mL of undiluted bisphenol A/epichlorohydrin resin was applied to one eye. Ocular redness, congestion of the third eyelid and hyperaemia were observed in all the animals up to 72 hours post application. However, all pathological changes resolved after seven days. The average irritation score after seven days was 0 (NICNAS, 2015).

E. Sensitisation

In a local lymph node assay (LLNA) conducted in six female CBA/J mice, a single daily dose of read-across substance BADGE (CAS RN 1675-54-3) (in an acetone/olive oil vehicle (4:1 v/v)) was applied to the dorsal surface of both ears at a dose of 0 % (vehicle only), 0.3 %, 1 %, 3 %, 10 % or 30 % for three consecutive days. No erythema or effects on body weight were observed. The estimated concentration needed to produce a three-fold increase in lymphocyte proliferation (EC3) was calculated to be 5.7 % (ECHA). [Kl. Score = 1]

Bisphenol A/epichlorohydrin resin and read-across substance BADGE were found to be moderately sensitising to guinea pigs based on various tests including the Buehler method and guinea pig maximisation test (GPMT) (NICNAS, 2015).

In humans, contact dermatitis has been noted in individuals exposed in an occupational setting. The authors of one study established that bisphenol A/epichlorohydrin resin was responsible for the dermal sensitisation potential of the resin (Health Canada, 2019).

F. Repeated Dose Toxicity

Oral

No studies were available for bisphenol A/epichlorohydrin resin.

In a study conducted in Fischer 344 (F344) rats (65 animals/sex/dose), undiluted read-across substance BADGE (CAS RN 1675-54-3) (suspension in 0.5 % methyl cellulose ethers with 0.1 % Tween 80) was administered by oral gavage at doses equivalent to 0, 50, 250, or 1000 mg/kg bw/d for seven days per week for 14 weeks. This study was initially intended to be a two-year study but had to be terminated at days 99 (male) or 101 (females) due to excessive toxicity. Before the study termination at 14 weeks, six animals died or had to be euthanised due to moribund conditions (three died incidentally during dosing or blood collection; three in the high dose group had moderate to severe acute tubular necrosis of the kidneys). Slight decreases in body weights and feed consumption were observed in the 250 and 1000 mg/kg bw/d groups compared with controls. The only other significant treatment-related effects that were observed were increased serum cholesterol (in the 50 mg/kg group) and increased caecum size (in the 250 and 1000 mg/kg groups). While the effect on cholesterol was only seen at the low dose and could therefore be discounted, this finding was also made at low doses in a further study below. The no observed adverse effect level (NOAEL) value could not be established for this study (NICNAS, 2015).

In a two-year study conducted in F344 rats (65 animals/sex/dose), undiluted read-across substance BADGE (suspended in Tween 80 and methylcellulose) was administered by oral gavage at doses equivalent to 0, 2, 15, and 100 mg/kg bw/d for up to two years. No statistically significant mortalities were observed in the study groups. Similar to the study above, serum cholesterol was increased in the 15 and 100 mg/kg bw/d group and caecal enlargement was observed in the 100 mg/kg bw/d group. There were also statistically significant decreases in absolute and relative spleen weights and very slight atrophy of the red pulp was observed in the 100 mg/kg bw/d group. The NOAEL value was determined to be 15 mg/kg bw/d (NICNAS, 2015).

Dermal

Based on a 13-week dermal study conducted in male B6C3F1 mice, read-across substance BADGE did not cause any systemic effects with doses of up to 100 mg/kg bw/d. However, mild to moderate dermatitis was observed in the highest dose group (100 mg/kg bw/d). The maximum tolerated dose (MTD) was determined to be 100 mg/kg bw/d based on spongiosis and epidermal micro abscess. The NOAEL for dermal effects was not determined in this study (NICNAS, 2015).

Inhalation

No data available.

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on bisphenol A/epichlorohydrin resin and read-across substance BADGE are shown in Table 3. Read-across is considered scientifically justified based on the shared structural features, functional groups, and comparable composition, particularly the high content of BADGE monomer in the bisphenol A/epichlorohydrin resin (ECHA)

Table 3 *In vitro* Genotoxicity Studies on bisphenol A/epichlorohydrin resin

Test System	Results		Klimisch Score	Reference
	-S9	+S9		
Bacterial reverse mutation (*S. typhimurium* strains TA 1535, TA 1537, TA 98 and TA 100)	+	+	1	ECHA
Gene mutation study in mammalian cells (L5178Y mouse lymphoma assay)**	+	-	1	ECHA

*+, positive; -, negative

**using read-across substance BADGE (CAS RN 1675-54-3)

The EFSA Scientific Panel on Food Additives Flavourings, Processing Aids and Materials in Contact with Food concluded that read-across substance BADGE was a direct-acting mutagen *in vitro* (NICNAS, 2015).

In Vivo Studies

Although read-across substance BADGE, was considered to cause genotoxic effects *in vitro*, studies evaluating the mutagenic potential *in vivo* were negative.

In an *in vivo* mammalian somatic cell study: cytogenicity / erythrocyte micronucleus conducted on male and female ICR mice, read-across substance BADGE induced no significant increases in micronucleated polychromatic erythrocytes over the levels observed in the negative controls in either sex or at any of the sacrifice times (ECHA). [Kl. Score = 1]

In a transgenic rodent mutagenicity assay conducted according to OECD Guideline 488 , there was no treatment-related mortality and no evidence of an increase in mutant frequency at the cII gene in liver, duodenum, or glandular stomach of F344 Big Blue® male rats after 28 days of once daily oral gavage treatment with BADGE, at doses ranging from 50 mg/kg/day up to the limit dose of 1000 mg/kg/day (ECHA). [Kl. Score = 1]

Negative results were also observed in the following tests: micronucleus test in the bone marrow of female mice; induction of DNA repair synthesis in human mononucleated white cells; dominant lethal test in mice through topical and single oral administration of BADGE; induction of liver DNA damage in rats; and nuclear abnormalities and chromosome aberrations in Chinese hamster bone marrow (NICNAS, 2015).

H. Carcinogenicity

Subcutaneous injections of bisphenol A/epichlorohydrin resin in male Long Evans rats produced malignant tumours at the site of injection. Experiments in CF1 mice that were exposed to bisphenol A/epichlorohydrin resin and epichlorohydrin by skin application exhibited skin tumours (NICNAS, 2015).

The IARC concluded that read-across substance BADGE is 'not classifiable as to its carcinogenicity to humans' (Group 3) (IARC, 1989). The available data evaluated included the following:

- dermal application in F344 rats did not produce neoplasia in any tissue at doses of 1000 mg/kg;
- a dietary study in 30 male Heston A strain mice using 2 % BADGE had incidences of pulmonary tumours (12/23) compared with the controls (15/29);
- a dermal application of 5% BADGE in C3H mice and albino rabbits did not produce any skin tumours; and,
- a dermal application of undiluted BADGE resulted in the occurrence of a single skin papilloma in one of the tested C3H mice. However, the authors noted that in a second, similar experiment, skin tumours were not observed.

The studies given above contain mixed results as to the carcinogenicity of BADGE and bisphenol A/epichlorohydrin resin. Studies that showed positive results used chemicals that include epichlorohydrin as an impurity and this is a known carcinogen (NICNAS, 2015).

I. Reproductive and Developmental Toxicity

No evidence of embryo/foetal toxicity or teratogenicity was observed at any dose in studies conducted on bisphenol A/epichlorohydrin resin and similar epoxy resins (CAS RN 25085-99-8 and 25036-25-3). In a dermal teratology study, rabbits were administered doses of 0, 100, 300, or 500 mg/kg/day on days 6–18 of gestation. No evidence of embryo/foetal toxicity or teratogenicity was observed at any dose. Gavage teratology studies using both rats and rabbits with a low molecular weight BADGE-based epoxy resin were conducted at dose levels of 0, 60, 180, and 540 mg/kg/day in rats, and dose levels of 0, 20, 60, and 180 mg/kg/day in rabbits. There were no adverse effects on mean litter size, pre- and post-implantation losses, or any evidence of a teratogenic or embryotoxic effect at any dose level (Bingham and Cohrssen, 2012 cited in Health Canada, 2019). Dermal exposure in pregnant rabbits at doses of 100, 300 or 500 mg/kg bw/day between gestational days 6-18 was not embryo toxic or teratogenic. Teratology studies in rats at the oral doses of 60, 80 and 540 mg/kg bw/day and the rabbits at oral doses of 20, 60, and 180mg/kg bw/day did not result in changes in litter size, pre- or post-implantation losses or any evidence of teratogenic or embryo toxicity. A one generation reproductive study in rats at oral doses of 20, 60, 180 and 540 mg/kg bw/day did not affect reproductive parameters in either sex and any of the doses tested (Poole et al., 2004 cited in Health Canada, 2019). A dietary carcinogenicity study in mice at a concentration of 10% or dermal studies in mice at concentrations up to 5% with exposure 3 times weekly for 2 years did not result in any increases in the presence of tumours, therefore the resins had a low subchronic toxicity in rodent studies and were not reproductive/developmental toxicants or carcinogenic in vivo (Bingham and Cohrssen, 2012 cited in Health Canada, 2019).

In a reproductive and developmental toxicity study, female Sprague Dawley (SD) rats (12 animals/dose) were exposed daily to read-across substance BADGE (in corn oil) by oral gavage at

doses of 0, 375, 1500, and 3000 mg/kg bw/d on gestation days (GD) 6–20 and postnatal days 0–21. All the animals in the 3000 mg/kg bw/d group died before labour. Significant mortality at the 1500 mg/kg bw/d group was also reported. The pups exhibited no pathological changes in any of the major organs. Although transient changes in relative organ weights were observed, these were not supported by histopathological findings (NICNAS, 2015).

Testicular effects were explored in another study in male SD rats. Male SD rats (five animals/dose) were administered with a single dose of read-across substance BADGE (in corn oil) through gastric lavage at doses of 0 (corn oil only), 500, 750, 1000 and 2000 mg/kg bw/d. The body weight and the relative testes weight of the treated groups were lower compared with controls. In terms of sperm parameters, no significant differences were observed except for two animals in the 2000 mg/kg group, which showed lower sperm head count and motility as well as higher sperm abnormalities compared with controls (NICNAS, 2015).

J. Derivation of Toxicological Reference and Drinking Water Guidance Values

The toxicological reference values developed for bisphenol A/epichlorohydrin resin follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2021).

Non-Cancer

No studies were available for bisphenol A/epichlorohydrin resin. Limited repeat dose toxicity studies were available for read-across substance BADGE. The NOAEL from the one study available is 15 mg/kg bw/day based on the two-year oral toxicity study in rats. The NOAEL of 15 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:
UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 1
UF_D (database uncertainty) = 10

Oral RfD = 15/(10 x 10 x 1 x 1 x 10) = 15/1000 = 0.015 mg/kg bw/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

where:
Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)

Drinking water guidance value = (0.015 x 70 x 0.1)/2 = 0.053 mg/L

Cancer

Insufficient evidence of carcinogenicity exists in rat, mice and rabbit chronic studies conducted on bisphenol A/epichlorohydrin resin and read-across substance BADGE. Thus, a cancer reference value was not derived.

K. Human Health Hazard Assessment of Physico-Chemical Properties

Bisphenol A/epichlorohydrin resin does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidizing potential

7 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

The acute and chronic toxicity of bisphenol A/epichlorohydrin resin is of moderate concern to aquatic organisms. No studies are available for terrestrial organisms. However, low toxicity to sediment-dwelling organisms is expected.

B. Aquatic Toxicity

Acute Studies

Table 4 lists the results of acute aquatic toxicity studies conducted on bisphenol A/epichlorohydrin resin.

Table 4: Acute Aquatic Toxicity Studies on bisphenol A/epichlorohydrin resin

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Salmo gairdneri (Gairdner's trout)	96-hr EC_{50}	3.6	-	Health Canada, 2019
Pimephales promelas (Fathead minnow)	96-hr EC_{50}	3.1	-	Health Canada, 2019
Oryzias latipes (Japanese rice fish)	96-hr EC_{50}	1.41	-	Health Canada, 2019
Daphnia magna (Water flea)	48-hr EC_{50}	>0.143 *	1	ECHA
Daphnia magna (Water flea)	48-hr LC_{50}	1.1 to 2.8**	1	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	1.4 to 1.7	-	Health Canada, 2019
Raphidocelis subcapitata (Green alga)	72-hr EC_{50}	9.4	-	Health Canda, 2019

*48-hr EC50 was beyond range of the concentrations tested; exceeded a geometric mean concentration of 143 µg/L and exceeded the maximum solubility in water.
**Read-across substance BADGE (CAS RN 1675-54-3)

Chronic Studies

No chronic studies are available for bisphenol A/epichlorohydrin resin in fish, invertebrates and algae.

A 21-day NOEC of 0.3 mg/L was determined for *Daphnia magna* in read-across substance BADGE (CAS RN 1675-54-3). (ECHA). [Kl. Score = 1]

A 72-hour NOEC of 4.2 mg/L (water soluble fraction) was determined for *Scenedesmus capricarnutum* (green alga) based on growth rate in read-across substance BADGE (CAS RN 1675-54-3) (ECHA). [Kl. score = 1].

Bisphenol A/epichlorohydrin resin exhibits lower water solubility and therefore the actual dissolved concentrations of the toxicologically active species in the aquatic environment are expected to be lower than those attained in the study conducted with read-across substance BADGE. Consequently, the bioavailable fraction and resulting chronic aquatic toxicity of bisphenol A/epichlorohydrin resin is anticipated to be equal or lower than those observed for BADGE. (ECHA).

C. Terrestrial Toxicity

No studies are available for bisphenol A/epichlorohydrin.

D. Calculation of PNEC

The PNEC calculations for bisphenol A/epichlorohydrin resin follow the methodology discussed in DEWHA (2009).

PNEC water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (1.41 mg/L), invertebrates (1.1 mg/L), and algae (9.4 mg/L). Results from chronic studies on a read-across substance are available for invertebrates (0.3 mg/L) and algae (4.2 mg/L). On the basis that the data consists of short-term studies for three trophic levels and long-term results studies for two trophic levels, an assessment factor of 50 has been applied to the lowest reported NOEC of 0.3 mg/L for invertebrates. The $PNEC_{water}$ is 0.006 mg/L.

PNEC sediment

There are no toxicity data for sediment-dwelling organisms. Moreover, the substance is subject to hydrolysis, not expected to substantially partition to sediments and thus have low toxicity to sediment-dwelling organisms (Health Canada, 2019). Nonetheless, a $PNEC_{sed}$ was calculated using the equilibrium partitioning method for a hydrolysis product. The $PNEC_{sed}$ is 0.0055 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$

$= 1.16/1280 \times 1000 \times 0.006$

$= 0.0055$ mg/kg

Where:

$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)

BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 kg/m^3[default]

$PNEC_{water}$ = 0.006 mg/L

$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$

$= 0.8 + [(0.2 \times 0.76)/1000 \times 2400]$

$= 1.16\ m^3/m^3$

And:

Kp_{sed} = solid-water partition coefficient (L/kg)

BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 kg/m^3[default]

$Kp_{sed} = K_{oc} \times f_{oc}$

$= 19 \times 0.04$

$= 0.76$ L/kg

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for the substance hydrolysis product is 19 L/kg (Health Canada, 2019).
f_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC soil

There are no toxicity data for terrestrial or soil organisms. Moreover, the substance is expected to be hydrolytically unstable under environmental conditions. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method for a hydrolysis product. The $PNEC_{soil}$ is 0.0015 mg/kg soil dry weight.

The calculations are as follows:
$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
$= (0.38/1500) \times 1000 \times 0.006$
$= 0.0015$ mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 kg/m^3 [default]

$Kp_{soil} = K_{oc} \times f_{oc}$
$= 19 \times 0.02$
$= 0.38\ m^3/m^3$

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for the substance hydrolysis product is 19 L/kg (Health Canada, 2019).
f_{oc} = fraction of organic carbon in soil = 0.02 [default].

8 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REAC Criteria methodology (IChEMS, 2022; ECHA, 2023).

Bisphenol A/epichlorohydrin resin is not readily biodegradable based on a read-across substance; and, thus does meet the screening criteria for persistence.

Based on a measured log K_{ow} of 3.6, bisphenol A/epichlorohydrin resin does not meet the screening criteria for bioaccumulation.

The lowest chronic NOEC for bisphenol A/epichlorohydrin resin is >0.1 mg/L for invertebrates and algae based on a read-across substance. The lowest acute $E(L)C_{50}$ value is >1 mg/L in fish, invertebrates and algae. Thus, bisphenol A/epichlorohydrin resin does not meet the screening criteria for toxicity.

The overall conclusion is that bisphenol A/epichlorohydrin resin is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for bisphenol A/epichlorohydrin resin.

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9 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
Bisphenol A/epichlorohydrin resin	25068-38-6	Not a PBT	No	No	Yes	No	No	No	2	2 (Inv), 1 (Algae)	2

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 2 - Hazard Assessment and Qualitative Assessment Only. Develop toxicological profile and PNECs for water and soil and provide qualitative discussion of risk.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

10 REFERENCES, ABBREVIATIONS AND ACRONYMS

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B. Abbreviations and Acronyms

%	percent
°C	degrees Celsius
ADWG	Australian Drinking Water Guidelines
AICS	Australian Inventory of Chemical Substances
BCF	bioconcentration factor
COC	constituent of concern
DEWHA	Department of the Environment, Water, Heritage and the Arts
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
HHRA	enHealth Human Risk Assessment
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
Kl	Klimisch scoring system
K_{oc}	organic carbon-water partition coefficient
kPa	kilopascal
L	litre
L/kg	litres per kilogram
LC	lethal concentration
LD	lethal dose
LOAEL	lowest observed adverse effect level
m^3	cubic metre
mg/kg	milligrams per kilogram
mg/L	milligrammes per litre
mg/m^3	milligrams per cubic metre
mL	millilitre
mPa s	millipascal second
NAMW	number average molecular weight

NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NOAEL	no observed adverse effect level
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RfD	Reference Dose
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency
UVCB	Unknown or Variable Composition, Complex Reaction Products and Biological Materials

1,2-BENZISOTHIAZOL-3(2H)-ONE

This dossier on 1,2-benzisothiazol-3(2H)-one (also referred to as BIT) presents the most critical studies pertinent to the risk assessment of the chemical in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA) and from National Industrial Chemicals Notification and Assessment Scheme (NICNAS) Inventory Multi-tiered Assessment and Prioritisation (IMAP) Assessments. Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – BIT was not identified in chemical databases used by NICNAS as an indicator that the chemical is of concern and is not a PBT substance. BIT was assessed as a tier 3 chemical for acute and chronic aquatic toxicity. Therefore, BIT is classified overall as a **tier 3** chemical and requires a quantitative risk assessment for end uses.

1 BACKGROUND

The methylisothiazolinone in this assessment belongs to a larger group of preservatives and industrial biocides, which all have an isothiazolinone heterocyclic ring system. Methylisothiazolinones are made industrially by oxidative cyclisation of the linear organic di-sulfide, N,N'-dimethyl-3,3'-dithiodipropionamide (CAS RN 999-72-4), in a process that uses chlorine as the oxidant.

BIT is biodegradable at expected environmental exposure concentrations, is not expected to bioaccumulate, and has a low potential to adsorb to soil or sediment.

BIT has a low to moderate potential for acute oral and inhalation toxicity and no potential for acute dermal toxicity. BIT is moderately skin irritating, severely eye irritating and a skin sensitiser. Repeated-dose oral toxicity studies identified adverse effects associated with increased incidence of histopathological lesions on the non-glandular portion of the stomach; however, these effects are attributed to the local irritant effects of the chemical. The substance is not genotoxic or carcinogenic. It is not expected to cause reproductive or developmental toxicity.

BIT exhibits significant acute and chronic toxicity to aquatic organisms and has a low toxicity to terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): 2,3-dihydro-1,2-benzothiazol-3-one (alternate IUPAC listed as 1,2-benzothiazol-3-one)

CAS RN: 2634-33-5

Molecular formula: C_7H_5NOS

Molecular weight: 151.19 g/mol

Synonyms: –1,2-benzisothiazol-3(2H)-one; BIT; benzisothiazolone; 3-hydroxy-1,2-benzisothiazole; proxel; benzo[d]isothiazol-3-ol

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for these substances are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Mixture of BIT

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Solid. The substance can vary in colour from white to brown	1	ECHA
Melting Point	157.1°C at 101.3 kPa	1	ECHA
Boiling Point	substance decomposes above 300 °C	1	ECHA
Density	1,483 kg/m^3 @ 20°C	-	NCBI, 2026
Vapor Pressure	2.55 x 10^{-4} Pa @ 25°C (mean value)	1	ECHA
Partition Coefficient (log K_{ow})	0.7 @ 20°C	1	ECHA
Water Solubility	1.288 g/L @ 20°C	1	ECHA
Dissociation Constant (pKa)	7.01 (temperature not provided)	-	USEPA, 2026
Viscosity	Not applicable, substance is a solid	-	-

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for BIT.

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

BIT is biodegradable at expected environmental exposure concentrations, is not expected to bioaccumulate, and has a low potential to adsorb to soil or sediment.

B. Partitioning

BIT is readily soluble in water (ECHA).

Based on a calculated Henry's law constant of 0.00071 Pa m^3/mol, BIT is not expected to volatilize from water or moist soil or sediment surfaces. BIT is also not expected to volatilize from dry surfaces based on its vapor pressure (NCBI, 2026).

Based on hydrolysis measurements made using OECD Guideline 111, BIT was stable (<10% degradation) at pH 4, 7 and 9. The rate constant was found to be 0.00317 per day and the half-life to be 145 days (ECHA). [KI. Score = 1].

In the presence of sunlight, BIT is susceptible to rapid photodegradation (ECHA). In air, a half-life of 7.568 hours was identified (ECHA) [KI. Score = 1]. In water, one study could not calculate a half-life due to rapid photodegradation (ECHA) [KI. Score = 1] while another study identified a half-life of 4 hours (ECHA) [KI. Score = 2].

C. Biodegradation

In an activated sludge test under aerobic conditions using OECD Guideline 301 C (Ready Biodegradability: Modified MITI Test (I)), 63% degradation was measured after 4 days and ultimately attained 85% biodegradation by Day 63 (ECHA) [KI. Score = 1].

In a supporting study performed according to OECD Guideline 301B (Ready Biodegradability: CO2 Evolution Test), there was evidence of aerobic biodegradation of 14^C-labelled BIT at 1 mg C/L (1.8 mg/L as BIT) in 30 mg/L activated sludge. Up to 42.1% mineralisation was observed over 28 days. The exposure period was extended and produced up to 62.2% mineralisation over 83 days. In the test vessels with 14^C-labelled BIT at 5 mg C/L (9 mg/L as BIT) in 30 mg/L activated sludge, very low levels of mineralisation were observed (<10%), which was attributed to microbial toxicity of BIT at this concentration (ECHA). [KI. Score = 1]

In several other supporting studies, inherent biodegradability was also observed (ECHA).These studies show that BIT, whilst not readily biodegradable, degrades when the sludge concentration is sufficient to counter any biocidal effects of the test substance. Thus, supporting the conclusion that BIT is biodegradable at more realistic environmental exposure concentrations (NICNAS, 2020a).

Degradation studies of BIT in soil identified rapid biodegradation with a half life of <1 day (NICNAS, 2020a; ECHA).

If a chemical is found to be readily or inherently biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

D. Environmental Distribution

An OECD Guideline 121 test (Estimation of the Adsorption Coefficient (K_{oc}) on Soil and on Sewage Sludge using High Performance Liquid Chromatography [HPLC]) was conducted on BIT. The mean soil organic carbon partition coefficient (K_{oc}) was 0.97 L/kg, and was within a 95% confidence range interval of 0.76 to 1.19 L/kg (ECHA). [KI. Score =1]

Based upon this K_{oc} value, if released to soil, BIT is expected to have a low potential for adsorption and a high potential for mobility. If released to water, based on its K_{oc} and water solubility values, BIT is likely to remain in water and not adsorb to sediment or suspended solids.

E. Bioaccumulation

Based on experimental data, BIT is not expected to bioaccumulate. In a study compatible with OECD Guideline 305, *Lepomis macrochirus* (bluegill sunfish) were exposed to 0.1 mg/L of BIT in natural water and a BCF of 6.62 L/kg was determined. At environmental levels of 0.01 and 0.1 mg/L, the substance did not appear to represent a bioconcentration hazard to fish (ECHA) [KI. score = 2].

The low bioconcentration potential, hydrophilicity, and the reactivity of BIT with biomolecules indicate that BIT will also not biomagnify in aquatic or terrestrial food webs (NICNAS, 2020a).

6 HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

BIT is absorbed via the gastrointestinal tract and the skin (estimated dermal absorption of 40 – 50%). BIT has a low to moderate potential for acute oral and inhalation toxicity and no potential for acute dermal toxicity. BIT is moderately skin irritating, severely eye irritating and a skin sensitiser. Repeated-dose oral toxicity studies identified adverse effects associated with increased incidence of histopathological lesions on the non-glandular portion of the stomach; however, these effects are attributed to the local irritant effects of the chemical. The substance is not genotoxic or carcinogenic. It is not expected to cause reproductive or developmental toxicity.

B. Toxicokinetics and Metabolism

BIT is absorbed via the gastrointestinal tract and the skin.
A study was conducted to study the absorption, distribution and excretion profile of the substance in Sprague-Dawley rats. The toxicokinetic profile was determined at 4, 8, 24, 48 and 72 hours following a single oral administration or a single topical application of the radiolabelled test substance at approximately 10 mg/kg bw (5 MBq/kg). At 8 hours after a topical application, 3.2% of the radiochemical dose was absorbed and 23.9% remained in the treated skin and was, therefore, available for absorption. At 72 hours after a topical application, 41.6% of the radiochemical dose was absorbed and 47.6% remained in the treated skin and was, therefore, available for absorption. Radioactive material was rapidly and extensively absorbed through the skin and from the gastrointestinal tract. At 8 hours after an oral administration, 96.6% of the radiochemical dose was detected in samples other than the gastrointestinal tract. At 72 hours after a topical application, 41.6% of the radiochemical dose was absorbed and 47.6% remained in the treated skin and was, therefore, available for absorption. The primary route of excretion was in the urine, with 96.6% of

the activity absorbed following topical application and 99.5% of the radiochemical dose following oral administration, being excreted by this route in 72 hours. Very little material was detected in the faeces, indicating that the majority of the radioactive material is absorbed following oral administration and that biliary excretion is unlikely to occur to any great extent (low levels of radioactive material were detected in the faeces and gastrointestinal tract (less than 0.5% of the radiochemical dose combined) following topical application). The test substance does not appear to be broken down to volatile components or excreted in the expired carbon dioxide, as indicated by high overall recoveries and low trap levels (less than 0.05% of the radiochemical dose) of radioactivity in trapping solutions. Tissue disposition does not appear to occur (ECHA). [Kl. Score = 1]

In a dermal absorption study, maximum dermal absorption of 40.6 % was measured at 72 hours in rats following the application of BIT to the skin for durations of 4–72 hrs (US EPA, 2005). No other details were provided. (NICNAS, 2020b)

In a skin absorption study conducted in accordance with OECD 428 (Skin absorption: in vitro method), 0.01 % w/v aqueous benzisothiazolinone was applied to human dermatomed skin. The absorbed dose of the chemical was 25.63 % and the total dislodgeable dose was 42.05 % of the applied dose. The SCCS (2012) concluded that the applicable dermal absorption was 61.9 % of the applied dose (1.29 µg/cm²) when an aqueous solution of 0.01 % benzisothiazolinone was applied. (NICNAS, 2020b)

The SCCS (2012) assumed 50 % oral absorption but did not provide details of how this value was estimated. (NICNAS, 2020b)

C. Acute Toxicity

Oral

A study was conducted to determine the acute oral toxicity of BIT according to a method similar to OECD Guideline 401. Groups of five male and five female Wistar rats were administered a single oral dose of 0, 100, 300, 500 or 900 mg/kg bw of the test substance in a 0.5% (w/v) aqueous polysorbate 80 suspension. The animals were weighed and observed for fourteen days after dosing. There was no mortality at 100 and 300 mg/kg. One female at 500 mg/kg bw was sacrificed in extremis. At 900 mg/kg bw there were signs of marked toxicity and all the males and three females died or were sacrificed in extremis on Day 1 or 2. There were no macroscopic abnormalities in any animal at necropsy. Under the study conditions, the acute oral LD_{50} of the substance was determined to be 670 mg/kg bw (490 mg a.i./kg bw) in rats (ECHA). [Kl. Score = 1]

In an acute oral toxicity study (USEPA OPP 81-1 method), male and female Sprague-Dawley rats were exposed to 1000, 2000, or 5000 mg/kg bw/day (823, 1646, or 4115 mg/kg active ingredient) of BIT by oral gavage. Based on the findings, the Acute Oral Defined LD50 was calculated to be 1450 mg/kg bw/day The LD50 for males was 2100 mg/kg bw/day. The data did not permit calculation of the LD50 for females. Graphically, the LD50 for females was estimated to be 1050 mg/kg. (SCCNFP, 2004)

Inhalation

In an acute inhalation toxicity study (USEPA OPPTS 870.1300), male and female Sprague-Dawley rats were exposed to 50, 500 and 2,000 mg/m^3 BIT for 4 hours. Chamber concentration and particle size distributions of the test substance were determined periodically during the exposure period. Surviving animals were observed for mortality, signs of gross toxicity and behavioural changes at least once a day for 14 days following exposure or until death occurred. Body weights were recorded prior to exposure and again on days 1,3,7 and 14 or after death. Necropsies were performed on all animals. Based on the findings, the acute inhalation calculated defined LC_{50} was 50,000 mg/m^3 for male rats and 570 mg/m^3 in female rats with a combined LC_{50} of 500 mg/m^3 for both sexes (ECHA). [Kl. Score = 1]

Dermal

A study was conducted to determine the acute dermal toxicity of BIT in rats according to OECD Guideline 402. The test substance was applied to the closely-clipped dorsum of a group of five male and five female CD rats at a dosage of 2000 mg/kg bodyweight and was covered by an occlusive dressing for 24 hours. Mortality, systemic and local signs of reaction to treatment were recorded during a subsequent 14-day period of observation. The animals were sacrificed on Day 15 and subjected to necropsy. There was no mortality and no systemic signs of reaction to treatment. Local signs comprised of very slight or well-defined erythema, slight exfoliation and eschar formation. The animals achieved expected bodyweight gains and necropsy revealed no significant macroscopic lesion. Under the study conditions, the acute dermal LD_{50} of the substance in rats was determined to be greater than 2000 mg/kg bw (ECHA). [Kl. Score = 2]

In an acute dermal toxicity study (USEPA OPP81-2 method), male and female Sprague-Dawley rats were exposed topically to 5000 mg/kg bw/ day (4115 mg/kg active ingredient) of BIT. The animals were exposed for 24 hours and observed for 14 days. The animals were observed for signs of gross toxicity and mortality at least once daily for another 14 days. Bodyweights were recorded just prior to application and again on days 7 and 14 (termination). Necropsies were performed on all animals at terminal sacrifice. All animals survived, gained weight and appeared active and healthy during the study. There were no signs of gross toxicity, adverse pharmacologic effects or abnormal behaviour. Gross necropsy findings at terminal sacrifice were generally unremarkable. Based on the results of testing, the single dose Acute Dermal Toxicity LD_{50} is greater than 5000 mg/kg bw/day. (SCCNFP, 2004)

D. Irritation

Skin

A study was conducted to determine the skin irritation potential of BIT in rabbits according to a method similar to OECD Guideline 404. A group of three male New Zealand white rabbits received a single four-hour application of 500 mg (moistened with 0.5 mL water) of the test sample to the shaved flank. The animals were assessed for up to 4 days for any signs of skin irritation. No sign of dermal irritation was observed in any of the test animals at any time point. Under the study conditions, the substance was not considered to be irritating to rabbit skin (ECHA). [Kl. Score = 2]

A study was conducted to determine the skin irritation potential of BIT in rabbits according USEPA Guideline OPP 81 -5. A group of six male New Zealand white rabbits received a single four-hour

application of 500 mg (moistened with 0.5 mL water) of the test sample to the shaved flank. The animals were assessed for up to 4 days for any signs of skin irritation. Very slight or well defined erythema was observed on the application sites of all animals up to Day 2 or 3. Very slight oedema was present on 5 of the 6 animals, which persisted in 2 animals till Day 3. No other signs of irritation were seen. Under the study conditions, the substance was not considered to be irritating to rabbit skin (ECHA). [Kl. Score = 2]

In another irritation study (USEPA OPP 81-5 method), male and female New Zealand albino rabbits were exposed to 0.5 g/0.5 ml water (41.15% a.i.) for four hours under semi occlusive conditions. All animals appeared active and healthy throughout the duration of the study. One hour after patch removal, well-defined moderate erythema and oedema was noted at all treated sites. This decreased with time. Desquamation occurred at one site, and all animals were free of erythema and oedema by day 7. The primary dermal irritation index was 2.8 based on the 1-72 hours evaluation averages. BIT is moderately skin irritating. (SCCNFP, 2004)

Eye

In an irritation study (USEPA OPP 81-4 method), male and female New Zealand albino rabbits were exposed to 0.1 g of undiluted BIT. The sample was instilled into the right eye. The treated eyes of 3 rabbits were rinsed 20-30 seconds after instillation; the eyes of the remaining 6 animals were not rinsed. From 1 to 48 hours, all treated eyes exhibited severe to maximal irritation including corneal opacity, iritis and conjunctivitis. Overall, the severity of irritation increased with time. Due to the irreversible nature of the irritation the test was terminated after 48 hours. The test substance was severely irritating to the rabbit eye (SCCNFP, 2004 and ECHA). [Kl. Score = 1]

E. Sensitisation

Isothiazolinones, including BIT, are considered to be skin sensitisers (NICNAS, 2020b).

A study was conducted to determine the skin sensitisation potential of BIT according to USEPA Guideline OPP 81-6 (Guinea Pig Maximisation Test). The test was performed in 50 (20 test, 10 negative control and 20 positive control) female albino Dunkin Hartley guinea pigs. The intradermal induction of sensitisation in the test group was performed in the scapular region with a 0.01% dilution of the test substance in purified water in an emulsion of Freund's Complete Adjuvant (FCA)/physiological saline (1st Application). The epidermal induction of sensitisation was conducted for 48 h under occlusion with the test substance at 30% in dimethyl formamide one week after the intradermal induction (2nd Application). The animals of the control group were intradermally induced with DMF under occlusion. Two weeks after epidermal induction the control and test animals were challenged by epidermal application of the test substance at 10% in DMF on the left flank and 3% in DMF on the right flank occlusive dressing. Cutaneous reactions were evaluated at 24 and 48 h after removal of the dressing. Challenge of previously induced guinea pigs with a 10% (w/v) preparation of the test substance in DMF elicited a moderate skin sensitisation response and challenge with a 3% (w/v) preparation elicited a mild skin sensitisation response. Under the study conditions, the substance was considered to be a moderate skin sensitiser (ECHA). [Kl. Score = 1]

In humans, retrospective studies of large numbers of patients with diagnosed allergies indicate significantly high rates of positive patch test reactions to BIT. In these studies, BIT was not always included in patch tests at dermatology centres. Therefore, the number of people actually sensitised to BIT may be higher than what has been reported. The concentrations of BIT used in patch tests at

different dermatology centres were 0.05 % and 0.1 %. In studies of patients with known allergies or contact dermatitis (Table A2 in Appendix 2 of NICNAS, 2020b):

- 7 out of 202 painters had a positive patch test reaction to 0.1 % BIT; and
- 4 out of 194 patients tested had a positive reaction to 0.05 % BIT only.

Reliable data to establish the relevant induction concentrations were not available. Cross-sensitisation with other isothiazolinones, such as MI or MCI (CAS RN 26530-03-0 and 26172-54-3, respectively), could not be ruled out as a cause of elicitation reactions (NICNAS, 2020b).

F. Repeated Dose Toxicity

Oral

A study was conducted to determine the sub-chronic repeat dose toxicity of technical grade BIT (93.3% purity) according to USEPA Guideline OPP 82 -1 (90-Day Oral Toxicity). Groups of twelve male and twelve female Alpk:APfSD rats were fed diets containing 0, 200, 900 or 4000 ppm of the test substance for a period of 90 days. The food consumption and bodyweight were monitored throughout the study and the average dose received by the animals in the 200, 900 and 4000 ppm groups was calculated as 15.3, 69.0 and 322.0 mg/kg/day for males, and 17.6, 78.3 and 356.3 mg/kg/day for females, respectively. There were no mortalities, all animals were observed to be in good clinical condition and any clinical signs recorded were considered to be of a type and incidence commonly seen in rats of this age and strain and therefore not considered to be treatment-related. The bodyweights of animals at the high dose were statistically significantly reduced throughout the study and a corresponding decrease in food consumption in the females of the high dose group. There was no effect on bodyweight at any other dose level. There were no observations in the haematology determinations considered to be treatment-related. A statistically significant increase in plasma alkaline phosphatase activity of males at high dose and statistically significant increases in plasma cholesterol levels of females at mid and high doses were observed. No macroscopic abnormalities were observed during necropsy of the test animals. The only macroscopic finding attributed to treatment was a thickened limiting ridge in the stomach of majority of the animals at high dose, which corresponded to the presence of a minimal, slight or moderate hyperplasia of the forestomach adjacent to the limiting ridge. A mixed inflammatory cell submucosal infiltrate accompanied the hyperplastic change in two males and six females. Based on the reduction in body weight and food consumption at the high dose, the sub-chronic systemic NOAEL of the substance in rats was determined to be 900 ppm (69.0 mg/kg/day in males and 78.3 mg/kg/day in females) (ECHA). [Kl. Score = 1]

A repeated dose oral toxicity study was conducted in accordance with OECD 407 guidelines. Male and female Wistar rats were exposed daily to 15, 45, or 135 mg/kg bw/day (12.63, 37.89, or 113.67 active ingredient (a.i.)) of 84.29% BIT by oral gavage for 28 days. Oral administration of BIT at 15 mg/kg/day bw (12.63 mg a.i./kg/day) had no adverse effect on general health, neurological effects, growth, food consumption, haematological and clinical chemistry parameters, organ weights and its ratios, gross and histopathological changes. Treatment related signs of slight salivation were observed in all the males in the main group at 135 mg/kg/day and its recovery group from treatment day 17 and in two females from the test group and two in the recovery group from treatment day 20 till the end of the treatment period. During the recovery period, treatment related signs of salivation were not observed in the 135 mg/kg/day group indicating the reversibility of the effect. Body weight was unaffected in the 15 and 45 mg/kg/day groups. At 135mg/kg/day there was a significant decrease in weight gain and cumulative weight gain in the male group except for the first week

where it was not statistically significant. Weekly body weights were significantly lower in the high dose (135 mg/kg/day) recovery period for males and on weeks 4, 5, and 6 for females. The only treatment related effect seen in the 45-mg/kg/day group was that lesions were seen in the non-glandular stomach, which could be related to the irritant/corrosive effect of the test substance and were not seen in the other groups. The NOAEL in this study was 15 mg/kg/day bw (12.63 mg a.i./kg/day). (SCCNP, 2004; NICNAS, 2020b).

A subchronic oral toxicity study was conducted in accordance with OECD 408 guidelines, where male and female Wistar rats were exposed daily to 10, 30, or 75 mg/kg bw/day 84.9% BIT by oral gavage for 90 days. The oral administration of BIT at 10 mg/kg/day (8.42 mg a.i./kg/day) body weight had no adverse effect on general health, neurological effects, growth, food consumption, haematological and clinical chemistry parameters, sperm evaluation, organ weights and its ratios and gross and histopathological changes. At 30 mg/kg/day (25.26 mg a.i./kg/day) there were no treatment related clinical signs. Food consumption was lower in females in weeks 2 and 4. There were some changes primarily in the non-glandular stomach region both macroscopically and histologically which were considered treatment related and were reversible. These effects may have been due to the irritant nature to the test substance. At 75 mg/kg/day (63.15 mg a.i./kg/day) there was a significant reduction in food consumption in males and less so in females, which returned to control levels in the recovery period. The NOAEL in this study was 10 mg/kg/day bw (8.42 mg a.i./kg/day) (SCCNP, 2004). However, this study confirms the SCCNP (2004) findings that the histopathological lesions reported at the mid-dose were due to the irritant properties of the chemical and therefore the NOAEL for systemic effects is 25.26 mg/kg bw/day (NICNAS, 2020b).

Inhalation

No data available

Dermal

No data available

G. Genotoxicity

Based on the available in vitro and in vivo genotoxicity studies, BIT is not considered to be genotoxic. Although BIT shows clastogenic activity *in vitro*, two adequately performed *in vivo* tests in two different tissues provide no evidence for genotoxic potential (EFSA, 2007).

In Vitro Studies

The *in vitro* genotoxicity studies on BIT are presented in Table 3.

Table 3: *In vitro* Genotoxicity Studies on BIT

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial Reverse Mutation Test (OECD 471) *Salmonella typhimurium* (TA1535, TAl537, TA1538, TA98 and TA100)	-	-	2	ECHA
In vitro Mammalian Cell Gene Mutation Assay (OECD 476) mouse lymphoma L5178Y cells	-	-	1	ECHA
In vitro Mammalian Chromosomal Aberration Test (OECD 473)	+	+	1	ECHA

*+, positive; -, negative

In Vivo Studies

In an Unscheduled DNA Synthesis (UDS) test (OECD 486), Wistar rats were administered BIT (0, 375, or 750 mg a.i./kg bw) by oral gavage. There was no indication of induction of UDS by the test item. The two positive controls induced a significant increase of UDS. The test item does not induce UDS in rat hepatocytes in in vivo treatment (ECHA). [Kl. Score = 1]

A study was conducted to determine the in vivo genotoxic potential of BIT according to OECD Guideline 474 (Mammalian Erythrocyte Micronucleus Test). Male and female mice were given a single oral gavage of test substance (99.8% purity) at 300, 600 or 1200 mg/kg bw. Concurrent vehicle and positive control groups of mice were dosed with corn oil or chlorambucil (30 mg/kg bw) respectively. Five males and five females from each group were sacrificed 24 hours after treatment and five males and five females at 1200 mg/kg bw or the vehicle control were sacrificed 48 and 72 hours after treatment. Bone marrow smears on glass slides were made from each animal. These slides were then stained and prepared for examination. At least 2000 erythrocytes per animal were examined for the presence of micronuclei, using the light microscope. No real indication of bone marrow toxicity, as evidenced by depression of bone marrow proliferation, was noted in any treated group. Frequencies of micronucleated polychromatic erythrocytes in all test groups were similar to those in concurrent vehicle controls. This lack of treatment-related effect was apparent in both sexes, and was confirmed by statistical analysis. Under the study conditions, the substance was not considered to be genotoxic (ECHA). [Kl. Score = 1]

In another Mammalian Erythrocyte Micronucleus Test (OECD 474), Swiss albino mice were administered BIT (0, 63.15, 126.3, or 210.5 mg a.i./kg) by oral gavage, twice at 24 hr intervals. The animals were sacrificed 24 hrs after the second treatment. In all treated mice, there was a reduction of the ratio PCE/NCE, thus indicating that the test item has reached the target cells. The positive control, CPA, induced several MN significantly higher than the untreated animals. BIT did not induce a number of MN higher than the untreated animals. BIT is not clastogenic in mice, treated in vivo (SCCNP, 2004).

H. Carcinogenicity

No data available

I. Reproductive and Developmental Toxicity

A two-generation reproductive toxicity study was conducted in WI(Glx/BRL/Han)BR rats according to US EPA Guideline OPPTS 870.3800. Groups of 24 male and 24 female rats (P generation) were administered the test substance by diet at dose levels of 250, 500 or 1000 ppm (equivalent to 27.0, 54.2 and 112.0 mg/kg bw/day). A similar group received the control diet only. The animals received the test diet for 10 weeks before pairing for two weeks. The dosing continued during this pairing period and throughout the resulting pregnancies. The P generation females were allowed to litter and rear their offspring (F1a) to weaning. Administration of the test substance continued throughout the weaning of the F1 offspring until necropsy. 24 animals of each sex were randomly selected from each group to form the F1 generation. Treatment of the F1 generation at dose levels of 250, 500 and 1000 ppm (equivalent to 28.2, 56.6 and 114.8 mg/kg/day) through diet continued during their maturation period (10 weeks), the mating period (up to two weeks) and throughout the resulting pregnancies and weaning of the F2 offspring up until necropsy. All F1 females were allowed to litter and rear their offspring (F2a) to weaning.

Clinical observations, body weights and food intake of the P generation were unaffected by treatment. Mating data, duration of gestation, numbers of implantations, numbers of pups born and pup survival were similar in all groups. In F1, the mean pup weight gain of the high dose pups was slightly lower than control over the first week post-partum. However, over the whole lactation period, mean pup weight gain was similar in all groups. There were no adverse effects of treatment on the seminology data. Minor limiting ridge hyperplasia in the stomach was noted in some intermediate and many high dose F1 animals. Squamous cell hyperplasia and forestomach gastritis were also seen in few animals. F1 males in the high dose group gained slightly less body weight than the controls during the study and the high dose females gained slightly less body weight during the pre-pairing period only. Clinical observations and food intake of F1 were unaffected by treatment. Physical development of the F1 generation, mating data, duration of gestation and F2a pup sex ratio were unaffected by treatment. Pup survival till Day 4 post-partum and mean pup weight gain were slightly lower in the high dose group compared to control. Seminology investigations, organ weights and ovarian follicle counts were unaffected by treatment. In the intermediate and high dose F1 animals, limiting ridge hyperplasia in the stomach was noted. This was most prominent in the high dose females where there was also squamous cell hyperplasia, forestomach gastritis, hyperkeratosis and erosion/ulcer.

Based on the study results, it was concluded that, dietary administration of the test substance at 1000 ppm to rats for two generations produced toxicity in the F1 generation in terms of lower body weight gain, and in both generations, limiting ridge hyperplasia of the stomach together with incidences of squamous cell hyperplasia, forestomach gastritis, keratosis and erosion/ulcer. At this dose, the growth of the offspring was slightly impaired and in the F2a generation, there was a slight reduction in pup survival probably as a consequence of maternal toxicity. Under the study conditions, the systemic NOAEL of the substance in rats was considered to be 112 mg/kg/day in P generation, 56.6 mg/kg/day in F1 generation and 56.6 mg/kg/day in the F2 generation considering the local nature of the gastric irritation produced by the test substance administration. The NOAEL for reproductive toxicity of the substance in rats was considered to be 112 mg/kg/day (ECHA). [Kl. Score = 1]

J. Derivation of Toxicological Reference and Drinking Water Guidance Values

Toxicological reference values were derived for BIT using methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011) as shown below.

Non-Cancer

A 90-day repeat dose oral toxicity study has been conducted in rats with BIT. No treatment-related systemic toxicity was observed at doses up to 30 mg/kg/day (25.26 mg a.i./kg/day), although there was histopathological lesions in the non-glandular stomach these were reversible and likely due to the irritant properties of the test substance. The NOAEL from this study for systemic effects (25.26 mg/kg bw/day) will be used to derive the oral reference dose. This NOAEL was used by NICNAS in the national assessment of chemicals associated with coal seam gas extraction in Australia (NICNAS, 2017).

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:
UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1

Oral RfD = 25.26/(10 x 10 x 1 x 10 x 1) = 25.26/1000 = 0.025 mg/kg-day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD:

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:
Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)

Drinking water guidance value = (0.025 x 70 x 0.1)/2 = 0.088 mg/L

Cancer

No studies are available. Based on the information for BIT from the genotoxicity studies, BIT is not expected to be carcinogenic. Thus, a cancer reference value was not derived.

K. Human Health Hazard Assessment of Physico-Chemical Properties

BIT does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

7 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

BIT exhibits significant acute and chronic toxicity to aquatic organisms. BIT has low toxicity to terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 4 lists the results of acute aquatic toxicity studies conducted on BIT.

Table 4 Acute Aquatic Toxicity Studies on BIT

Test Species	Endpoint	Results (mg a.i./L)	Klimisch Score	Reference
Oncorhynchus mykiss (Rainbow trout)	96-hour LC_{50}	2.15	1	ECHA
Oncorhynchus mykiss (Rainbow trout)	96-hour LC_{50}	0.167	-	ECOTOX; NICNAS, 2020a
Daphnia magna (Water flea)	48-hour EC_{50}	2.9	1	ECHA
Daphnia magna (Water flea)	48-hour EC_{50}	0.097	-	ECOTOX; NICNAS, 2020a
Raphidocelis subcapitata (Green alga)	72-hour EC_{50}	0.108 (geometric mean)	1	ECHA

Chronic Studies

No chronic studies are available for fish or invertebrates.

Algae: In a study conducted according to OECD Guideline 201 (Alga, Growth Inhibition Test) on *Raphidocelis subcapitata*, a 72-hr NOEC of 0.04 mg a.i./L was determined based on growth rate (ECHA). [Kl. Score = 1].

C. Terrestrial Toxicity

BIT is slightly toxic to soil dwelling invertebrates and plants (NICNAS, 2020a).

In a 14-day OECD Guideline 207 study (Earthworm, Acute Toxicity Tests), *Eisenia fetida* (earthworms) were allocated to artificial soil containing 43.8, 77.1, 133.9, 234.5, and 410.6 mg a.i./kg dry weight (dw) (nominal concentrations). There were no observed effects on behaviour or morphology after the initial reluctance to burrow into the artificial soil. Statistical analysis indicated that there was no significant effect on weight change compared to the control at any treatment concentration. Under the study conditions, the nominal 14 -day LC_{50} and NOEC (based on growth) of the test substance in Eisenia fetida were determined to be greater than 410.6 mg/kg dw. The NOEC based on mortality was 234.5 mg a.i./kg dw (ECHA) [KI. Score = 1].

In a 20-day OECD Guideline 208 study (Terrestrial Plants Test: Seedling Emergence and Seedling Growth Test) the toxicity of three plant species (*Phaseolus vulgaris* [dwarf bean], *Triticum aestivum* [wheat], *Brassica oleracea var. capitata* [cabbage]) was evaluated for treated soil (as sand) containing 0, 51, 101, 203, 406, and 812 mg a.i./kg dw for wheat and 0, 10, 30, 90, 270, and 812 mg a.i. /kg dw for dwarf bean and cabbage. Under the study conditions, the lowest EC_{50} and NOEC were determined to be 200 and 30 mg a.i./kg dry soil respectively for cabbage on the basis of growth (seedling dry weight) (ECHA) [KI. Score = 1].

In a 28-day OECD Guideline 216 study (Soil Microorganisms: Nitrogen Transformation Test) with microorganisms, the test soil was amended with BIT concentrations of 0, 3.2, 9.7, 29.2, 89.3, 263.7, and 811.5 mg a.i./kg dw. The test substance showed no inhibitory effect on the nitrogen transformation activity of soil micro-organisms, at concentrations up to and including 263.7 mg a.i./kg dry soil. At the highest test concentration, the test substance had a negative impact (a reduction of 29.6%) on the formation of Nitrate-N when compared with the control. Under the study conditions, the EC_{50} and NOEC based on the inhibition of nitrogen transformation were determined to be >811.5 and 263.7 mg a.i./kg dry soil respectively (ECHA) [KI. Score = 1].

D. Calculation of PNEC

The PNEC calculations for BIT follow the methodology discussed in DEWHA (2009).

$PNEC_{water}$

Experimental results are available for three trophic levels. Acute EC_{50} values are available for fish (0.167 mg/L), invertebrates (0.097 mg/L) and algae (0.11 mg/L). Results from chronic studies are also available for one trophic level, with the lowest NOEC value being 0.04 mg/L for algae. On the basis that the data consists of short-term results from three trophic levels and long-term results from one trophic level, an assessment factor of 100 has been applied to the lowest reported NOEC of 0.04 mg/L for algae. The $PNEC_{water}$ for BIT is 0.0004 mg/L, which is the same value identified by NICNAS (2020a).

$PNEC_{sediment}$

There are no toxicity data for sediment-dwelling organisms. Moreover, the substance is not expected to substantially partition to sediments. Nonetheless, a $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 0.00026 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= 0.819/1280 \times 1000 \times 0.0004$
$= 0.00026$ mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 kg/m^3[default]
$PNEC_{water}$ = 0.0004 mg/L

$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 0.0388)/1000 \times 2400]$
$= 0.819\ m^3/m^3$

And:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 kg/m^3[default]

$Kp_{sed} = K_{oc} \times f_{oc}$
$= 0.97 \times 0.04$
$= 0.0388$ L/kg

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The experimental K_{oc} for BIT is 0.97 L/kg (ECHA).
f_{oc} = fraction of organic carbon in sediment = 0.04 [default].

$PNEC_{soil}$

In the ECHA REACH database (ECHA), a $PNEC_{soil}$ was derived for BIT using the experimental results from the lowest reported NOEC value of 30 mg a.i./kg dw reported in plants and an assessment factor of 10. The $PNEC_{soil}$ was determined to be 3 mg/kg soil dry weight.

8 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Biodegradation studies of BIT in water indicate low biodegradation, which is likely due to BIT's toxicity to microorganisms, and degradation increased when lower exposure concentrations of BIT were used. The rate of biodegradation in these tests in water does not satisfy the OECD criterion for readily biodegradability (60% in a 10-day window), but the results do show that BIT is biodegradable at more realistic environmental exposure concentrations. Degradation studies of BIT in soil identified rapid biodegradation with a half life of <1 day. Thus, BIT does not meet the criteria for persistence.

The experimental BCF for BIT is 6.62 L/kg in bluefish sunfish. Thus, BIT does not meet the criteria for bioaccumulation.

The chronic toxicity data on BIT has a NOEC < 0.1 mg/L. The lowest acute E(L)C_{50} values are also < 1 mg/L. Therefore, BIT meets the criteria for toxicity.

The overall conclusion is that BIT is not a PBT substance.

B. Other Characteristics of Concern

Only tier 3 chemicals which trigger persistence and bioaccumulative thresholds are considered to be chemicals with a potential for cumulative impacts. As noted in the prior section, BIT does not meet the criteria for persistence or bioaccumulation.

No other characteristics of concern were identified for BIT.

9 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
1,2-Benzisothiazol-3(2H)-one (BIT)	2634-33-5	Not a PBT	No	No	No	No	No	Yes	3	3	3

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 3 - Quantitative Risk Assessment: Complete PBT, qualitative and quantitative assessment of risk.

Notes:

CAS No. = chemical abstracts service number

COC = chemical of concern

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

10 REFERENCES, ABBREVIATIONS AND ACRONYMS

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B. Abbreviations and Acronyms

°C	degrees Celsius
µg/L	micrograms per litre
a.i.	active ingredient
ADWG	Australian Drinking Water Guidelines
AICS	Australian Inventory of Chemical Substances
bw	body weight
CAS RN	Chemical Abstract Services Registry Number
CFR	Code of Federal Regulations
COC	chemical of concern
DoEE	Department of the Environment and Energy

EC_{50}	median effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
GLP	Good Laboratory Practice
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg/m^3	kilogram per cubic metre
KI	Klimisch scoring system
K_{ow}	n-octanol/water partition coefficient
kPa	kilopascal
LC_{50}	lethal concentration 50%
LD_{50}	lethal dose 50%
LLNA	local lymph node assay
LOAEL	lowest observed adverse effect concentration
LOEC	lowest observed effect concentration
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
NOEL	no observed effect level
OECD	Organisation for Economic Co-operation and Development
Pa	Pascal
PBT	Persistent, Bioaccumulative and Toxic
PNEC	Predicted No Effect Concentration
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RfD	reference dose
SGG	Synthetic Greenhouse Gases
UDS	Unscheduled DNA Synthesis
USEPA	United States Environmental Protection Agency

BORIC ACID
SODIUM TETRABORATE DECAHYDRATE (BORAX)

This dossier presents the most critical studies pertinent to the risk assessment of two boron compounds (boric acid and borax) in their use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database, which provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Borax and boric acid were assessed as tier 1 chemicals for acute and chronic aquatic toxicity. Neither is a PBT substance. However, both substances were identified in chemical databases used by NICNAS as an indicator that the chemicals are of concern. Therefore, these substances are classified overall as **tier 2** chemicals and require a hazard assessment and qualitative assessment of risk.

1. BACKGROUND

Boric acid and borax are boron compounds. As boron is an essential plant nutrient, soluble boron compounds (including borax) have an agricultural application as fertilisers in boron deficient soils, with these compounds being applied directly to soil or as a foliar spray (NSW Agriculture, 2003). Boron compounds, including boric acid, are used in domestic coal seam gas (CSG) applications (Commonwealth of Australia, 2014).

Borax will transform into boric acid in the aquatic environment. In the environment boric acid is in equilibrium with borate anions. Degradation is not applicable to inorganic borates. Boric acid is highly soluble in water. Some partitioning to soil and sediment does occur, but this adsorption is pH dependent. It has a low potential for bioaccumulation. Borax and boric acid have low acute and chronic toxicity to aquatic organisms.

Borax exhibits low acute toxicity by the oral and dermal routes. In addition, Boric acid exhibits low acute toxicity by the oral, dermal and inhalation routes. Neither substance is a skin or eye irritant, nor a skin sensitizer. In aqueous media at physiological pH, borax will predominantly exist as un-dissociated boric acid. The developing foetus and the testes are the two most sensitive targets of boron toxicity in multiple species. The testicular effects include reduced organ weight and organ to body weight ratio, atrophy, degeneration of the spermatogenic epithelium, impaired spermatogenesis, reduced fertility, and sterility. The developmental effects from boron exposure include high prenatal mortality, reduced foetal body weight, and malformations and variations. Repeated inhalation exposure to read-across substance boron oxide resulted in slight irritation to the respiratory tract, but no systemic toxicity. Boric acid was not genotoxic, and boric acid and borax were not carcinogenic to rodents.

2. CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): boric acid

CAS RN: 10043-35-3

Molecular formula: BH_3O_3

Molecular weight: 61.84 g/mol

Synonyms: orthoboric acid; boracic acid; borofax; boron hydroxide; boron trihydroxide

Chemical Name (IUPAC): disodium bicyclo[3.3.1]tetraboroxane-3,7-bis(olate)

CAS RN: 1303-96-4

Molecular formula: $B_4Na_2O_7$

Molecular weight: 381.4 g/mol

Synonyms: sodium tetraborate decahydrate; borax; monosodium metaborate; sodium borate; sodium borate (NaBO2); sodium diborate; sodium meta borate; sodium metaborate; sodium tetraborate

3. PHYSICAL AND CHEMICAL PROPERTIES

Limited measured data are available for borax. In the environment, borax is expected to dissociate and/or hydrolyse to release boric acid at neutral pH. Therefore, measured data available for boric acid have been presented as analogue data for this substance.

Key physical and chemical properties for boric acid are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Boric Acid

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	White, odorless, crystalline solid	2	ECHA
Melting Point	>100°C (decomposes)	1	ECHA
Boiling Point	Not Applicable	-	ECHA
Density	1489 kg/m³ @ 20°C	1	ECHA
Vapor Pressure	0 Pa @ 25°C	1	ECHA

Property	Value	Klimisch score	Reference
Partition Coefficient (log K_{ow})	-1.09 @ 22 °C	1	ECHA
Water Solubility	48.8 g/L @ 20°C	1	ECHA
Dissociation Constant (pKa)	8.94 @ 20°C	1	ECHA
Viscosity	Not applicable, substance is a solid	-	ECHA

Boron is almost exclusively found in the environment as boron-oxygen compounds, which are often referred to as borates. The high strength of the B-O bond relative to those between boron and other elements makes boron oxide compounds stable compared to nearly all non-oxide boron materials. Indeed, the B-O bond is among the strongest found in the chemistry of naturally occurring inorganic substances (ECHA).

In the environment, borates and compounds of boric acid will dissociate and/or hydrolyse to form the same boron species. For example, when borax dissolves in dilute solutions, it dissociates into Na^+ ions and the tetraborate anion ($B_4O_5(OH)_4^{2-}$). Boric acid ($B(OH)_3$) is formed following acid catalysed hydrolysis of the tetraborate anion. Under alkaline conditions, dilute solutions of the tetraborate anion depolymerise rapidly to the mononuclear borate anion ($B(OH)_4^-$) (NICNAS, 2019).

Boric acid is a Lewis acid that acts as a weak monoprotic acid by accepting OH^- and not as a proton donor (pKa 9.14). Therefore, at the near neutral pH of most environmental systems and at low concentrations (<0.025 mol B/L), the neutral mononuclear species ($B(OH)_3$) will dominate and only a small proportion of boron will exist as the borate monoanion, $B(OH)_4^-$. Therefore, in the environment boric acid is in equilibrium with borate anions. Both species are very stable as they do not undergo biotransformation or redox reactions under normal environmental conditions (NICNAS, 2019).

Exposure to borates are often expressed in terms of boron (B) equivalents based on the fraction of boron in the source substance on a molecular weight basis. The B equivalents used are a generic designation rather than a designation of the element boron. The factor for converting boric acid to B-equivalents is 0.1748. The factor for converting borax to B-equivalents is 0.2149.

4. DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for boric acid or borax.

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No

Convention, Protocol or other international control	Listed Yes or No?
REACH (Substances of Very High Concern)	See Below
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

Boric acid and borax have both been identified as a Substance of Very High Concern and recommended for inclusion in Annex XIV (the Authorisation List) of the REACH legislation in the European Union based on its toxicity for reproduction (Article 57c). The chemicals are on the "Candidate List" and are not on the "Authorisation List". The chemicals are not currently identified as being of environmental concern (NICNAS, 2019).

5. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Borax will transform into boric acid in the aquatic environment. In the environment boric acid is in equilibrium with borate anions. Degradation is not applicable to inorganic borates. Boric acid is highly soluble in water. Some partitioning to soil and sediment does occur, but this adsorption is pH dependent. It has a low potential for bioaccumulation.

B. Partitioning

Borax will transform into boric acid in the aquatic environment. In the environment boric acid is in equilibrium with borate anions. Both species are very stable as they do not undergo biotransformation or redox reactions under normal environmental conditions. Boric acid is highly water soluble and it tends to remain in surface waters. Although some partitioning from water to soil and sediment does occur, the adsorption is pH dependent with the greatest adsorption occurring under alkaline conditions (pH 7.5 to 9.0) (NICNAS, 2019).

C. Biodegradation

Degradation is not applicable to inorganic borates. It is not subject to hydrolysis, photodegradation, or biodegradation (ECHA). Inorganic borates are subject to chemical transformation processes (adsorption, complexation, precipitation, fixation) once released into the environment (ECHA).

D. Environmental Distribution

The Kp value for boron compounds was calculated as the median of all measured Kp values from the GEMAS project (Geochemical Mapping of Agricultural and Grazing Land Soil project): 2.19 L/kg dry weight (ECHA) [KI. Score = 2]. The chemistry of boron in soils and aquatic systems is simplified by the absence of oxidation- reduction reactions or volatilization. Redox processes can mobilize Fe oxides and Mn oxides, which may lead to a release of boron in aquatic systems. Generally, sediments are characterised with higher pH values than the soil matrix, which increases the boron sorption capacity (ECHA).

If released to soil, based on this low Kp value, low vapour pressure and high water solubility, boric acid and borax are considered relatively mobile in the environment, under certain conditions (ECHA).

E. Bioaccumulation

The WHO review of boron (WHO, 1998) noted that "highly water soluble materials are unlikely to bioaccumulate to any significant degree and that borate species are all present essentially as un-dissociated and highly soluble boric acid at neutral pH". BCFs of <0.1 to 10.5 L/kg have been reported from laboratory tests of fish and oysters (Hamilton and Wiedmeyer, 1990; Thompson et al. 1976).

6. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Borax exhibits low acute toxicity by the oral and dermal routes. Boric acid exhibits low acute toxicity by the oral, dermal and inhalation routes. Neither substance is a skin or eye irritant, nor a skin sensitiser. In aqueous media at physiological pH, borax will predominantly exist as un-dissociated boric acid. The developing fetus and the testes are the two most sensitive targets of boron toxicity in multiple species. The testicular effects include reduced organ weight, organ to body weight ratio, atrophy, degeneration of the spermatogenic epithelium, impaired spermatogenesis, reduced fertility, and sterility. The developmental effects from boron exposure include high prenatal mortality, reduced fetal body weight, and malformations and variations. Repeated inhalation exposure to read-across substance boron oxide resulted in slight irritation to the respiratory tract, but no systemic toxicity. Boric acid was not genotoxic and boric acid and borax were not carcinogenic to rodents.

B. Toxicokinetics

Boric acid is not metabolised in either animals or humans, due to the high energy level required (523 kJ/mol) to break the B - O bond. Other inorganic borates convert to boric acid at physiological pH in the aqueous layer overlying the mucosal surfaces prior to absorption. Most of the simple inorganic borates exist predominantly as undissociated boric acid in dilute aqueous solution at physiological and environmental pH, leading to the conclusion that the main species in the plasma of mammals is un-dissociated boric acid. Since other borates dissociate to form boric acid in aqueous solutions, they exist as un-dissociated boric acid under the same conditions. Additional support for this derives from studies in which more than 90 % of administered doses of inorganic borates are excreted in the urine as boric acid. Absorption of borates via the oral route is nearly 100 %. For the inhalation route, complete (100 %) absorption is assumed as worst-case scenario. Dermal absorption through intact skin is very low (0.226% ± 0.125%) in humans. Using the % dose absorbed plus standard deviation (SD) for boric acid, a dermal absorption for borates of 0.5 % is assumed as a worse case estimate (ECHA).

In the blood, boric acid is the main species present and is not further metabolised. Boric acid is distributed rapidly and evenly through the body, with concentrations in bone 2 - 3 higher than in other tissues. Boric acid is excreted rapidly, with elimination half-lives of 1 hour in the mouse, 3 hours in the rat and < 27.8 hours in humans. Also, boric acid has a low potential for accumulation. Boric acid is mainly excreted in the urine (ECHA).

C. Acute Toxicity

The oral LD_{50} of borax in rats is > 2,500 mg/kg (NICNAS, 2017). In one of two key studies for boric acid, the oral LD_{50} of boric acid in rats is >2,600 mg/kg (ECHA) [KI. score = 1]. In the other key study,

the oral LD_{50} of boric acid in male rats is 3,450 mg/kg and in female rats is 4,080 mg/kg (ECHA) [KI. score = 2].

In one of two key studies for boric acid, the 4-hour inhalation LC_{50} value for boric acid in rats is >2,120 mg/m^3 (ECHA) [KI. score = 1]. In the other key study, the 5-hour inhalation LC_{50} value for boric acid in rats is >2,030 mg/m^3 (ECHA) [KI. score = 1]. A supporting study identified a 4-hour inhalation LC_{50} value for boric acid in rats of >160 mg/m^3 (ECHA) [KI. score =2]. The inhalation LC_{50} value in rats is >2,000 mg/m^3 for boric acid, borax, and disodium borates (NICNAS, 2017).

The dermal LD_{50} of boric acid in rabbits is >2,000 mg/kg (ECHA) [KI. score = 1].

D. Irritation

Borates have low potential for skin irritation (NICNAS, 2017). Application of 0.5 g of borax to the skin of rabbits for 4 hours under occlusive conditions was not irritating (NICNAS, 2017). The key study for boric acid concluded that application of 0.5 g of boric acid to the skin of rabbits for 24 hours under occlusive conditions was not irritating. The mean of the 24 and 72 hour scores were 0.11 for erythema and 0.00 for edema (ECHA) [KI. scores = 1].

For eye irritation, boric acid and borax induced mild conjunctivae redness and chemosis and minor effects on the iris, which may be related to the crystalline nature of the compounds (NICNAS, 2017). The effects were reversible within 7 days (NICNAS, 2017). The key study for boric acid concluded that instillation of 100 mg of boric acid into the eyes of rabbits was slightly irritating. The mean of 24, 48, and 72 hours scores were: 0.00 for corneal opacity, 0.11 for iridial lesions, 0.94 for conjunctival redness, and 0.56 for chemosis (ECHA) [KI. score = 1].

E. Sensitisation

There are no skin sensitisation studies on Borax. Read-across substances disodium tetraborate pentahydrate was not a skin sensitiser to guinea pigs in a Buehler test (ECHA) [KI. score = 1].

Boric acid was not a skin sensitiser to guinea pigs in a Buehler test (ECHA) [KI. score = 1]. Other studies concluded that boric acid and borax were not skin sensitisers to guinea pigs in Buehler tests (NICNAS, 2018).

F. Repeated Dose Toxicity

Oral

Male and female SD rats were given 0, 52.5, 175, 525, 1,750 or 5,250 ppm B equivalents in their feed for 90 days. The average intake has been estimated to be approximately 0, 2.6, 8.8, 26, 87.5, or 262.5 mg B/kg-day, respectively (USEPA, 2004). By week 6, all animals in the highest dose died. Clinical signs in the top two dose levels were rapid respiration, inflamed eyes, swollen paws, and desquamated skin on the paws and tails. There was also reduced food consumption and body weight gain. The 1,750 ppm females showed reduced liver, spleen ovary, and adrenal weights; the 1,750 ppm males showed reduced liver, spleen, kidney, testes, and adrenal weights. The adrenals of 4 males at 1,750 ppm showed minor increases in lipid content and size of the cells in the zona reticularis. Atropied testis (complete atrophy of the spermatogenic epithelium and decreased in the size of the seminiferous tubules) was seen in all males in the 1,750 ppm exposure group. One male

from the 525 ppm group had partial testicular atrophy. The NOAEL for this study is 175 ppm boron or 8.8 mg B/kg-day (Weir and Fisher, 1972 as cited in ECHA) [Kl. score = 2].

Male and female B6CF1_1 mice were given 0, 1,200, 2,500, 5,000, 10,000 or 20,000 ppm boric acid in the diet for 13 weeks (control and highest dose group) or 16 weeks (remaining dose groups). These dietary levels correspond to approximately 0, 34, 70, 141, 281, and 563 mg B/kg-day for males, respectively and 0, 47, 97, 194, 388 and 776 mg B/kg-day for females, respectively (USEPA, 2004). There was mortality (8/10 males; 6/10, females) in the 20,000 ppm, as well as hyperkeratosis and acanthosis. One male also died in 10,000 ppm group. Degeneration or atrophy of the seminiferous tubules occurred in the ≥5,000 ppm males. Minimal to mild extramedullary hematopoiesis of the spleen was observed in all dose groups. The LOAEL for this study is 1,200 ppm, corresponding to 34 and 47 mg B/kg-day for males and females, respectively (NTP 1987 as cited in ECHA) [Kl. score = 2].

Male and female SD rats were given 0, 117, 350 or 1,170 ppm boric acid in their diet for two years. The average intake was estimated to be 0, 5.9, 17.5 or 58.5 mg B/kg-day, respectively (USEPA, 2004). The 1,170 ppm rats had decreased food consumption during the first 13 weeks of the study and suppressed growth throughout the study. Signs of toxicity in the 1,170 ppm animals included swelling and desquamation of the paws, scaly tails, inflammation of the eyelids, and bloody discharge from the eyes. All males in the 1,170 ppm group had testicular atrophy at the 6, 12, and 24 month time points. The seminiferous epithelium was atrophied and the tubular size in the testes was decreased. There were significant decreases in the absolute and relative testes weights. Brain and relative thyroid weights were increased. The NOAEL for this study is 350 ppm B equivalents or 17.5 mg B/kg-day (Weir and Fisher, 1972 as cited in ECHA) [Kl. score = 2].

Male and female B6C3F_1 mice were given up to 20,000 ppm boric acid in their feed for 13 weeks (NTP, 1987). Eight out of the ten males and six out of the ten females from the 20,000 ppm group died and one of the ten males from the 10,000 ppm group died before end of study. Symptoms included nervousness, haunched appearance, dehydration, foot lesions and scaly tails. Incidences of extra medullary heamatopoiesis of spleen observed of varying severity in all dose groups for both males and females and hyperkeratosis and/or acanthosis of the stomach observed at the highest dose only in both males and females. At doses > 5,000 ppm (142 mg B/kg bw for the male), degeneration or atrophy of the seminiferous tubules was observed. The NOAEL for this study is 34 mg B/kg-day (NTP, 1987 as cited in ECHA) [Kl. score = 2].

Rats were given doses of 0, 25, 50, and 100 mg/kg-day of borax in their drinking water for 30 and 60 days. After 30 days, symptoms included decreased epididymal weight, increased plasma follicle-stimulating hormone, and decreased diameter of seminiferous tubules. Between 30 and 60 days, symptoms included testicular atrophy and loss of germinal elements. At 60 days, symptoms included decreased testes and liver weight and changes in testicular enzyme activity. The LOAEL for this study is 25 mg/kg-day (NICNAS, 2017).

Inhalation

Male and female rats were exposed by inhalation to 0, 77, 175, or 470 mg/m^3 boron oxide. The exposures were 6 hours/day, 5 days/week for 24, 12, and 10 weeks for the 77, 175, and 470 mg/m^3 concentrations groups, respectively. The MMAD were 2.5, 1.9, and 2.4 µm for the 77, 175, and 479 mg/m^3 concentrations groups, respectively. There was no evidence of systemic toxicity. Some of the 470 mg/m^3 had reddish exudate from the nose. As these animals were covered with dust, this effect may have been local irritation of the nose and from the animals scratching the nose. The NOAEL for

systemic toxicity is 470 mg/m^3, the highest exposure concentration tested. The NOAEL for localized effects (irritation) is 175 mg/m^3 (ECHA). [Kl. score = 2]

Dermal

No studies are available.

G. Genotoxicity

In Vitro Studies

There are no *in vitro* genotoxicity studies on borax. Table 3 presents the results of the *in vitro* genotoxicity studies on boric acid.

Table 3 In vitro Genotoxicity Studies on Boric Acid

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial reverse mutation (*S. typhimurium* strains)	-	-	1	ECHA
Bacterial reverse mutation (*S. typhimurium* strains)	-	-	2	ECHA
Mammalian cell gene mutation (mouse lymphoma L5178Y cells)	-	-	1	ECHA
Chromosomal aberrations (Chinese Hamster Ovary cells)	-	-	1	ECHA
Chromosomal aberrations (Chinese Hamster Ovary cells)	-	-	1	ECHA
Chromosomal aberrations (Human peripheral lymphocytes)	NS	+	2	ECHA
Unscheduled DNA synthesis (rat liver cells)	NA	-	1	ECHA

*+, positive; -, negative; NA, not applicable; NS, not specified.

In Vivo Studies

No studies are available on borax.

Male and female Swiss Webster mice were given two daily doses of 0, 225, 450, 900, 1,800, or 3,500 mg/kg boric acid. The frequency of micronucleated polychromatic erythrocytes were not increased at any dose level (ECHA) [Kl. score = 1].

H. Carcinogenicity

Oral

Male and female SD rats were given disodium tetraborate decahydrate (Borax) or boric acid at doses of 0, 117, 350, or 1,170 ppm as B equivalents (approximately 0, 5.9, 17.5, or 58.5 mg B/kg-day) in their diet for two years. There was no mention of tumors in the report. Nevertheless, NTP (1987)

concluded that this study provided adequate data on the lack of carcinogenic effects of boric acid in rats (NICNAS, 2018).

Male and female B6C3F_1 mice were given 0, 2,500, or 5,000 ppm boric acid in their diet for 103 weeks. The dietary levels are equivalent to 0, 446, or 1,150 mg/kg-day boric acid or 0, 78.1, or 201.3 mg B/kg-day. There was no evidence of carcinogenicity (NTP, 1987 as cited in ECHA) [Kl. score = 2].

I. Reproductive Toxicity

A three-generation reproductive toxicity study was conducted in Sprague-Dawley rats with boric acid. Male and female rats were fed a diet containing 0, 117, 350 or 1,170 ppm boron (approximately 0, 5.9, 17.5 or 58.5 mg B/kg-day, respectively). In the lower two dose groups, there were no treatment-related effects on reproduction. Litter size, progeny weights, fertility, live birth indices, lactation, appearance were similar to the controls. No gross abnormalities were noted in these two dose groups. The 1,170 ppm dose group were found to be sterile, and there were no litters from mating the treated females with control males. Lack of viable sperm was found in the atrophied testes of all 1,170 ppm males. Decreased ovulation was also seen in the majority of the ovaries of the 1,170 ppm females. The NOAEL for this study is 350 ppm boron or approximately 17.5 mg B/kg-day (Weir and Fisher, 1972 as cited in ECHA) [Kl. score = 2].

A three-generation reproductive toxicity study was conducted in Sprague-Dawley rats with borax. Male and female rats were fed a diet containing 0, 117, 350 or 1,170 ppm boron (approximately 0, 5.9, 17.5 or 58.5 mg B/kg-day, respectively). In the lower two dose groups, there were no treatment-related effects on reproduction. Litter size, progeny weights, fertility, live birth indices, lactation, and appearance were similar to the controls. No gross abnormalities were noted in these two dose groups. The 1,170 ppm dose group were found to be sterile, and there were no litters from mating the treated females with control males. Lack of viable sperm was found in the atrophied testes of all 1,170 ppm males. Decreased ovulation was also seen in most of the ovaries of the 1,170 ppm females. The NOAEL for this study is 155 ppm boron or approximately 17.5 mg B/kg-day following 2 years of exposure (NICNAS, 2018).

In a continuous breeding protocol, male and female CD-1 mice were given 0, 1,000, 4,500 or 9,000 ppm boric acid in their feed. The authors estimated that the average daily intakes were 0, 26.6, 111, and 220 mg B/kg-day to males and 0, 31.8, 152, and 257 mg B/kg-day to females. Boric acid consumption did not differ among the groups. There were no litters in the 9,000 ppm breeding pairs. At 4,500 ppm, there was a successful first litter, after which there was a progressive decrease in fertility; only one pair produced a fourth and fifth litter. All fertility indices were affected in the 4,500 ppm group. A complete crossover mating trial was conducted using control mice and the 4,500 ppm mice. The results showed that the probable cause of the reduced fertility was a decrement in male fertility. A dose-related decrease in body, testicular and epididymal weights was observed in the 4,500 and 9,000 ppm F_0 males. Sperm count was significantly decreased in these two dose groups, and percent motile sperm was decreased in all dose groups. Testicular histopathology showed seminiferous tubular atrophy in the 9,000 ppm males and partial atrophy of the seminiferous tubules in the 4,500 ppm males. There were no histopathologic changes in the 4,500 ppm females. There were no statistically significant decreases in mating index, fertility index, or live pups/litter in the 4,500 ppm females. However, the number of days to litter in this dose group was increased. Estrous cyclicity was unaffected. Reproductive organ weights were unaffected, but relative maternal liver and kidney/adrenal weights were reduced. An F_1 fertility trial was performed using offspring

from the 1,000 ppm groups. There was no decreases in mating, fertility or reproductive performance. The F_2 adjusted live pup weight was slightly, but significantly, reduced from controls. A clear NOAEL for reproductive toxicity in males was not seen in this study. The 1,000 ppm males had decreased sperm motility in the F_0 generation and decreased sperm concentration in the F_1 generation. Decreased F_2 pup relative body weight was statistically significant from controls. The NOAEL in this study for females is 1,000 ppm boric acid or 32 mg B/kg-day). A NOAEL was not established for males; the LOAEL was 1,000 ppm or 27 mg B/kg-day; (Fail *et al.* 1991 as cited in ECHA) [Kl. score = 2].

J. Developmental Toxicity

No studies are available on borax.

Pregnant female SD rats were given 0, 0.1, 0.2 or 0.4% boric acid in their feed on gestational days (GD) 0 to 20 or 0.8% boric acid on GD 6 to 15. The average amounts of boric acid ingested were estimated to be 0, 78, 163, 330 or 539 mg/kg-day (0, 13.6, 28.5 or 57.7 mg B/kg-day), respectively. Effects on the pregnant rats were altered food and/or water intake at ≥0.2% boric acid, increased liver and kidney weights relative to body weights at ≥0.2%, reduced weight gain at ≥0.4%, and increased corrected weight gain at 0.4% boric acid. There was a reduction in fetal body weights in all treated groups (94, 87, 63, and 47% of control weight, respectively). Increased malformations occurred at ≥0.2%, and prenatal mortality was increased at 0.8%. There was a dose-response for altered skeletal morphology in rats (≥0.1%), and specific findings were significantly elevated above controls at ≥0.2%. Specifically, there was an increased incidence of short rib XIII (a malformation) and a decreased incidence or rudimentary or full rib(s) at lumbar I (an anatomical variation) (Heindel *et al.* 1992 as cited in ECHA) [Kl. score = 2].

Pregnant female SD rats were given 0, 0.025, 0.005, 0.075, 0.1 or 0.2% boric acid in their feed on GD 0 to 20. Approximately half of the dams were terminated on GD 20, and the remaining dams delivered their litters. Pup growth and viability were monitored until postnatal day (PND) 21. The average amounts of boron ingested on GD 20 were 0, 3.3, 6.3, 9.6, 13.3, and 25 mg B/kg-day], respectively. The average amounts of boron ingested on PND 21 were 0, 3.2, 6.5, 9.7, 12.9, and 25.3 mg B/kg-day, respectively. There were no maternal deaths and no treatment-related clinical signs. Maternal body weights were similar across all groups during gestation. However, decreased maternal body weights (GD 19 and 20 at sacrifice) and decreased maternal body weight gain (GD 15-18 and GD 0-20) were statistically significant in trend tests. There was a 10% reduction in gravid uterine weight (statistically significant) in the 0.2% group. Corrected maternal weight (maternal gestational weight minus reduced gravid uterine weight) was unaffected by treatment. Feed intake in the 1,000 ppm dams was minimally affected and only during the first three days of dosing. Water consumption was higher in the treated groups after GD 15. The number of corpora lutea and uterine implantation sites, and the percentage of preimplantation loss were similar across all groups. Increased relative kidney weights were increased in the 0.2% group. There were no differences in the viability of the offspring between treated and controls. On GD 20, fetal body weight was 94% and 88% of controls in the 0.1% and 0.2% groups, respectively; recovery was complete at birth (~GD 22). The incidence of short rib XIII was increased on GD 20 in the ≥0.1% groups, but only in the 0.2% group at PND 21. The incidence of wavy rib was increased on GD 20 in the ≥0.1% group; the reversibility of this effect was confirmed on PND 21. There was a slight decrease in extra lumbar ribs in the 0.2% group on GD 20, and extra lumbar ribs were seen in the 0.2% group on PND 21. The developmental NOAEL was 0.075% boric acid or 9.6 mg B/kg-day on GD 20 and 0.1% boric acid or 12.9 mg B/kg-day on PND 21 (Price *et al.* 1996a as cited in ECHA) [Kl. score = 1].

Pregnant Swiss mice were given 0, 0.1, 0.2 or 0.4% boric acid in their diet on gestational days (GD) 0 to 17. The average amounts of boric acid ingested were estimated to be 248, 452 or 1,003 mg/kg-day (0, 43.4, 79.0 or 175.3 mg/B/kg-day), respectively. Maternal toxicity consisted of mild kidney lesions (≥0.1%), increased water intake and relative kidney weights (0.4%), and decreased water intake during treatment. Fetal body weights were reduced in the ≥0.2% groups, and there were increased incidences of resorptions and malformed fetuses per litter in the 0.4% group. The LOAEL for maternal toxicity is 248 mg/kg-day boric acid or 43.4 mg B/kg-day; a NOAEL was not established. The NOAEL for developmental toxicity is 248 mg/kg-day boric acid or 43.4 mg B/kg-day (Heindel *et al.* 1992 as cited in ECHA) [Kl. score = 2].

Pregnant female New Zealand rabbits were dosed by oral gavage with 0, 62.5, 125 or 250 mg/kg boric acid (0, 10.9, 21.9 or 43.7 mg B/kg) during GD 6-19. Feed intake was in the 250 mg/kg maternal animals during the exposure period, but it was increased in the ≥125 mg/kg dose groups. In the 250 mg/kg group, maternal body weights during GD 9-30, weight gain during GD 6-19, gravid uterine weight, and number of corpora lutea per dam were significantly reduced. In the ≥125 mg/kg groups, maternal corrected gestational weight gain was increased compared to controls. Maternal liver weights were unaffected by treatment. In the 250 mg/kg group, relative, but not absolute, kidney weights were increased, although no effects in the kidney were noted in the histopathological examination. Prenatal mortality was increased in the 250 mg/kg group (90% resorptions/litter versus 6% for controls); the proportion of pregnant females with no live fetuses was increased (73% versus 0%), and live litter size was reduced (2.3 fetuses versus 8.8). Thus, there were only 14 live fetuses (6 live litters) available for evaluation in the 250 mg/kg group. The percentage malformed fetuses/litter was increased in the 250 mg/kg group, primarily due to cardiovascular defects (72% versus 3% of controls). There was no definitive maternal or developmental toxicity in the 62.5 or 125 mg/kg dose groups. The NOAEL for maternal and developmental toxicity is 125 mg/kg-day boric acid or 21.9 mg B/kg-day (Price *et al.* 1996b as cited in ECHA) [Kl. score = 1].

K. Derivation of Toxicological Reference and Drinking Water Guidance Values

The toxicological reference values developed for boric acid follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

Non-Cancer

An oral reference dose was not derived for boric acid or borax.

The Australian drinking water guideline value for boron (4 mg/L) may be applicable (ADWG, 2011). The health-based ADWG value was based on a tolerable daily intake (TDI) of 0.16 mg/kg bw. This TDI is based on the NOAEL of 9.6 mg/kg bw/day for foetal bodyweight effects in a rat developmental study (Price et al. 1996a) with an uncertainty factor of 60 (10 for interspecies and 6 for human intraspecies).

Cancer

There was no evidence of carcinogenicity in rat and mouse chronic studies conducted on borax and/or boric acid. Thus, a cancer reference value was not derived.

L. Human Health Hazard Assessment of Physico-Chemical Properties

Borax and boric acid do not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidizing potential

7. ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Borax and boric acid have low acute and chronic toxicity to aquatic organisms.

B. Aquatic Toxicity

In ecotoxicological tests for boron, the exposure concentrations are expressed as boron equivalents (i.e., mg B/L). This is because boric acid and borate salts will have the same boron speciation when dissolved in environmental matrices. Therefore, in the following sections toxicological values are given as mg B/L regardless of the form of boron that was tested.

Acute Studies

Borax will transform into boric acid in the aquatic environment. Table 4 lists the results of acute aquatic toxicity studies conducted on boric acid.

Table 4 Acute Aquatic Toxicity Studies on Boric Acid

Test Species	Endpoint	Results (mg B/L)	Klimisch score	Reference
Fathead minnow	96-hr LC_{50}	79.7	2	ECHA
Legumia recta (Black sandshell mussel)	96-hr LC_{50}	147	2	ECHA
Megalonaias nervosa (Washboard mussel)	96-hr LC_{50}	>544	2	ECHA
Hyalella azteca	96-hr LC_{50}	64	2	ECHA
Pseudokirchneriella subcapitata	72-hr EC_{50}	52.4 mg B/L	1	ECHA

Chronic Studies

Long-term effects (LC_{10}) on freshwater fish ranged from 3.5 to 47 mg B/L. Adequate long-term LC_{10} of 21.6 mg B/L was found for the fresh water fish *P. promelas* in a study according to EPA OPPTS 850.1400 (ECHA) [Kl. Score = 2].

Long-term effects (LC10/NOEC) on reproduction on freshwater vertebrates ranged from 6.6 to 32 mg B/L based on several well-accepted guideline studies (ECHA) [Kl. Scores = 1 or 2].

Boric acid has been evaluated for its toxicity towards the freshwater alga *Pseudokirchneriella subcapitata* (formerly *Selenastrum capricarnutum*) in an Alga growth inhibition test according to OECD 201 under GLP requirements. The exposure duration was 72 hours under static conditions. The NOEC growth rate determined from the study was 17.5 mg B/L (ECHA) [Kl. Score = 1].

The ANZG water quality guideline (2021) derived a very high reliability default guideline value (DGVs) for (dissolved) boron in freshwater from 22 chronic (long-term) toxicity data, comprising eight fish, two amphibians, three crustaceans, one bivalve, three macrophytes, one green microalga, three diatoms and one blue–green alga. The summary of representative data used by ANZG to develop a water quality guideline for boron is presented in Table 5 below. These values are noted to be consistent with those reported in ECHA. Additional chronic aquatic toxicity data is found in the ANZG Technical Brief (ANZG, 2021).

Table 5 Chronic Aquatic Toxicity Studies on Boron[1]

Test Species	Endpoint	Results (mg B/L)
Dania rerio	34-day NOEC (Biomass)	1.8
Pimephales promelas	32-day NOEC (Mortality)	11
Daphnia magna	14-day NOEC (Reproduction)	2.4
Pseudokirchneriella subcapitata	4-day NOEC (Growth)	2.8

1 - The DGVs are based on toxicity data for boron as either boric acid, H_3BO_3 (CAS RN 10043-35-3), or borax, $Na_2B_4O_710H_2O$ (CAS RN 1303-96-4), in freshwater.

In the chronic toxicity data set, fish sensitivity to boron ranged from the least sensitive species in the dataset (*Melanotaenia splendida*, LC10 102 mg/L) to the third most sensitive species in the dataset (*Danio rerio*, NOEC 1.8 mg/L). Of the crustaceans, *D. mogno* was best represented in the literature with 18 published NOEC values (ranging from 2.4 mg/L to 29 mg/L) for six different endpoints from six different publications. The final NOEC of 2.4 mg/L used in the DGV derivation was lower than that for *C. dubia* (NOEC 5.6 mg/L) and for the amphipod *H. azteca* (NOEC 6.6 mg/L). For *P. subcapitata*, there were three separate studies available with toxicity data for boron. The toxicity values from these studies ranged from a NOEC of 2.8 mg/L to a NEC of 27 mg/L, varying with endpoint, duration and test medium used. Boron was least toxic to *P. subcapitata* when tested in algal growth medium with added $NaHCO_3$, suggesting that carbonate addition may have influenced boron toxicity. Therefore, although NECs are preferred to NOECs or EC10s (Warne et al. 2018), in this instance, a reliable NOEC of 2.8 mg/L was the most sensitive toxicity value for *P. subcapitata* (ANZG, 2021).

C. Sediment Toxicity

Limited sediment toxicity data are available for boric acid and boron containing compounds in general (NICNAS, 2019).

Chronic toxicity values for the effects of boric acid on sediment-dwelling invertebrates have been obtained for a freshwater midge (*Chiranamus riparius*, harlequin fly), a freshwater bivalve (*Lampsilis siliquoidea*, fatmucket clam), and the aquatic worm (*Lumbriculus variegatus*, California blackworm). The respective toxicity values for these species are as follows: 28-day NOEC = 37.8 mg B/kg, 21-day LC25 (survival) = 363.1 mg B/kg, and 28-day NOEC = 100.8 mg B/kg (NICNAS, 2019).

Due to the high water solubility of boron and its low partitioning to sediment, sediment toxicity testing for boron is particularly challenging. It is difficult to ensure that exposure is through the solid phase (i.e., sediment) and not from the aqueous boric acid in the overlying water (NICNAS, 2019).

D. Terrestrial Toxicity

Ecotoxicological tests with plants and soil invertebrates have recorded modest chronic toxicity values (NOECs/ECs) in the range of 15.3 to 84.0 and 5.2 to 315 mg total B/kg, respectively (ECHA, 2017). However, to predict the potential toxicity of boron to plants and soil organisms, measuring the total boron concentration may be unsuitable. Instead, potential toxicity is better predicted using boron concentrations in the soil solution (extractable boron) (Mertens, et al., 2011). In Australia, it is generally accepted that boron toxicity will pose a risk to terrestrial plants when soil concentrations exceed 15 mg/kg of extractable boron (NICNAS, 2019).

E. Calculation of PNEC

PNEC $_{water}$

The ANZG water quality guideline (2021) derived a very high reliability DGV for (dissolved) boron in freshwater. The DGVs for 99, 95, 90 and 80% species protection are 340 µg/L, 940 µg/L, 1,500 µg/L and 2,500 µg/L, respectively. The 95% species protection level for boron in freshwater (940 µg/L) is recommended for adoption in the assessment of slightly-to-moderately disturbed ecosystems. (ANZG, 2021).

PNEC $_{sediment}$

Limited sediment toxicity data are available for boric acid and boron containing compounds in general (NICNAS, 2019). Due to the high water solubility of boron and its low partitioning to sediment, sediment toxicity testing for boron is particularly challenging. It is difficult to ensure that exposure is through the solid phase (i.e., sediment) and not from the aqueous boric acid in the overlying water (NICNAS, 2019). K_{ow} and K_{oc} parameters do not readily apply to inorganics, such as boric acid and borax. Therefore, the equilibrium partitioning method cannot be used to calculate the $PNEC_{sed}$. As a result, the assessment of this compartment will be covered by the aquatic assessment.

PNEC $_{soil}$

In the ECHA REACH database (ECHA), a $PNEC_{soil}$ was derived for boron using the species sensitivity distribution method and an assessment factor of 2. The $PNEC_{soil}$ was determined to be 5.7 mg/kg soil dry weight.

8. CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU Reach Criteria methodology (IChEMS, 2022:ECHA, 2023).

Borax is an inorganic compound that dissociates completely to boric acid and the borate anion in aqueous media. Biodegradation is not applicable to these inorganic compounds; both boric acid and

borate are also ubiquitous and are present in most water, soil and sediment. For the purposes of this PBT assessment, the persistent criteria are not considered applicable.

A BCF of <0.1-10.5 L/kg has been reported for borates in fish and oysters. This data suggests that boric acid does not bioaccumulate in the aquatic environment. Thus, boric acid and borax do not meet the criteria for bioaccumulation.

The chronic toxicity data on boric acid has a NOEC > 0.1 mg/L. Acute E(L)C_{50} values are > 1 mg/L. Thus, borax and boric acid do not meet the criteria for toxicity.

The overall conclusion is that borax and boric acid are not PBT substances.

B. Other Characteristics of Concern

No other characteristics of concern were identified for borax or boric acid.

9. SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
Boric Acid	10043-35-3	Not a PBT	Yes	No	NA	No	No	No	1	1	2
Sodium Tetraborate Decahydrate (Borax)	1303-96-4	Not a PBT	Yes	No	NA	No	No	No	1	1	2

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 2 - Hazard Assessment and Qualitative Assessment Only. Develop toxicological profile and PNECs for water and soil and provide qualitative discussion of risk.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

10. REFERENCES, ABBREVIATIONS AND ACRONYMS

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
ANZG	Australian and New Zealand Guidelines
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
KI	Klimisch scoring system
KOCWIN™	USEPA organic carbon partition coefficient estimation model
kPa	kilopascal
L	litre
L/kg	litres per kilogram
LC	lethal concentration
LD	lethal dose
LOAEL	lowest observed adverse effect level
m^3	cubic metre
MCI	molecular connectivity index
mg/kg	milligrams per kilogram
mg/L	milligrammes per litre
mg/m^3	milligrams per cubic metre
mL	millilitre
mPa s	millipascal second
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NOAEL	no observed adverse effect level

NOEC	no observed effect concentration
NEC	no effect concentration
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RfD	Reference Dose
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

BUTANEDIOIC ACID, 2-SULFO-, 1,4-BIS(1,3-DIMETHYLBUTYL) ESTER, SODIUM SALT (1:1)
BUTANEDIOIC ACID, 2-SULFO-, 1,4-BIS(2-METHYLPROPYL) ESTER, SODIUM SALT (1:1)
BUTANEDIOIC ACID, SULFO-, 1,4-BIS-(2-ETHYLHEXYL) ESTER, SODIUM SALT

This dossier on butanedioic acid, 2-sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (1:1), butanedioic acid, 2-sulfo-, 1,4-bis(2-methylpropyl) ester, sodium salt (1:1), and butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

AICIS has evaluated butanedioic acid, 2-sulfo-, 1,4-bis(2-methylpropyl) ester, sodium salt (1:1) and concluded that there are no identified risks to the environment that require further regulation to manage.[1]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): sodium 1,4-bis[(4-methylpentan-2-yl)oxy]-1,4-dioxobutane-2-sulfonate

CAS RN: 2373-38-8

Molecular formula: $C_{16}H_{29}NaO_7S$

Molecular weight: 388.45 g/mol

Synonyms: butanedioic acid, 2-sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (1:1); succinic acid, sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt,

SMILES: [Na+].CC(C)CC(C)OC(=O)CC(C(=O)OC(C)CC(C)C)S([O-])(=O)=O

Chemical Name (IUPAC): sodium 1,4-bis(2-methylpropoxy)-1,4-dioxobutane-2-sulfonate

CAS RN: 127-39-9

Molecular formula: $C_{12}H_{21}NaO_7S$

Molecular weight: 332.34 g/mol

Synonyms: butanedioic acid, 2-sulfo-, 1,4-bis(2-methylpropyl) ester, sodium salt (1:1); succinic acid, sulfo-, 1,4-diisobutyl ester, sodium salt; Aerosol IB

SMILES: [Na+].CC(C)COC(=O)CC(C(=O)OCC(C)C)S([O-])(=O)=O

[1] https://cdnservices.industrialchemicals.gov.au/statements/EVA00199 - Evaluation Statement - 16 December 2025.pdf

Chemical Name (IUPAC): sodium 1,4-bis[(2-ethylhexyl)oxy]-1,4-dioxobutane-2-sulfonate

CAS RN: 577-11-7

Molecular formula: $C_{20}H_{37}NaO_7S$

Molecular weight: 444.56 g/mol

Synonyms: butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt; succinic acid, sulfo-, 1,4-bis(2-ethylhexyl) ester, sodium salt; Aerosol OT-B

SMILES: [Na+].CCCCC(CC)COC(=O)CC(C(=O)OCC(CC)CCCC)S([O-])(=O)=O

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of butanedioic acid group

Property	butanedioic acid, 2-sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (1:1)			butanedioic acid, 2-sulfo-, 1,4-bis(2-methylpropyl) ester, sodium salt (1:1)			butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt		
	Value	Klimisch Score	Reference	Value	Klimisch Score	Reference	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	White solid particulate/powder	2	ECHA	White solid coarse pieces	2	ECHA	Solid white pellets	2	ECHA
Melting Point	175°C @ 101.3 kPa	1	ECHA	164°C @ 101.3 kPa	1	ECHA	167.5°C @ 101.3 kPa	1	ECHA
Boiling Point	248°C @ 101.3 kPa	1	ECHA	229°C @ 101.3 kPa	1	ECHA	>200°C @ 101.3 kPa	1	ECHA
Density	1159 kg/m^3@ 20°C	1	ECHA	1299 kg/m^3@ 20°C	1	ECHA	1146 kg/m^3@ 20°C	1	ECHA
Vapour Pressure	0.078 Pa @ 20°C	2	ECHA	0.28 Pa @ 20°C	1	ECHA	0 Pa @ 25°C	2	ECHA
Partition Coefficient (log K_{ow})	0.0@ 20°C	1	ECHA	-3.326 @ 20°C	1	ECHA	1.998 @ 20°C	2	ECHA
Water Solubility	500 g/L @ 20°C	1	ECHA	500 g/L @ 20°C	1	ECHA	8.17 g/L @ 20°C	1	ECHA
Flash Point	Study not feasible	-	ECHA	Study not feasible	-	ECHA	Study not feasible	-	ECHA
Auto flammability	No Self Ignition	1	ECHA	No Self Ignition	1	ECHA	No Self Ignition	1	ECHA
Viscosity	Study not feasible	-	ECHA	Study not feasible	-	ECHA	Study not feasible	-	ECHA
Henry's Law Constant	Not available	-	ECHA	Not available	-	ECHA	Not available	-	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

The butanedioic acid group members are readily biodegradable. They are not expected to bioaccumulate. They have a low to moderate potential for adsorption to soil, sediments and suspended solids.

B. Biodegradation

Group members are readily biodegradable.

- Butanedioic acid, 2-sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (1:1) can be readily biodegradable: Although the key result shows average ultimate biodegradation on day 28 at 53 ± 8%, i.e. below the trigger of 60%, one of triplicate sample showed 61% of ultimate biodegradation on day 28, indicating potential for ready biodegradation, according to the criteria of OECD 301 test guideline. Furthermore, enhanced biodegradation assessment shows that the substance is ultimately biodegradable within 60 days of OED 301 F test design incubation since it reached 71 ± 11% (60-71-82%) on day 60 (ECHA). [KI. Score = 1]
- Butanedioic acid, 2-sulfo-, 1,4-bis(2-methylpropyl) ester, sodium salt (1:1): In an activated sludge study under aerobic conditions, there was 70% degradation after 28 days as determined by oxygen consumption (ECHA) [KI. Score = 1].
- Butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt: In an activated sludge study under aerobic conditions, there was 91.1% degradation after 28 days as determined by loss of total inorganic carbon (ECHA) [KI. Score = 1].

If a chemical is found to be readily or inherently biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

No experimental studies are available for group members. The soil organic carbon partition coefficient (K_{oc}) was estimated using the KOCWIN™ v2.00 module of EPI Suite for each substance as follows (ECHA) [KI. Score = 2]:

- Butanedioic acid, 2-sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (1:1): 44.5 L/Kg
- Butanedioic acid, 2-sulfo-, 1,4-bis(2-methylpropyl) ester, sodium salt (1:1): 10 L/Kg
- Butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt: 952 L/Kg

Based on these K_{oc} values, if released to soil, these substances are expected to have low to moderate adsorption. If released to water, based on these K_{oc} values and high water solubility, they are also expected to have low to moderate adsorption in sediment and suspended solids.

D. Bioaccumulation

Based on log K_{ow} values of 0, -3.326, and 1.998 L/Kg, respectively, group members have low potential for bioaccumulation. This is supported by a measured BCF of 9.33 L/kg in carp for butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt (ECHA). BCFs were not identified for the other two group members.

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Following oral exposure, a high degree of absorption occurs with two thirds of the administered dose found in the urine at 24 hours and all in the form of 2-ethylhexanol. These materials are moderately acutely toxic and non-toxic through the oral and dermal routes, respectively. These materials are irritating to the skin and severely irritating to the eyes. They are not skin sensitisers. Repeated dose toxicity demonstrated the potential for health impacts via oral exposure. These substances are not genotoxic and are not reproductive or developmental toxicants.

B. Metabolism

The absorption, excretion and metabolism of read-across substance dioctyl sodium succinate (DSS) have been investigated. Unlabelled DSS and radiolabelled compound (carbon-14) were used. Using a gas chromatographic procedure, a similarity in percent excretion of dose into urine was observed in rats dosed orally and intravenously, indicating a high degree of absorption of the oral dose. Confirmation of extensive absorption of DSS was obtained through oral dosage of 10 mg/kg carbon-14 labelled compound. Two thirds of the administered radioactivity was found in the urine at 24 hours after dosage. All activity was in the form of metabolites (2-ethylhexanol forming compounds) (ECHA) [Kl. Score=2].

C. Acute Toxicity

Oral

An acute oral toxicity study was conducted in accordance with OECD 401 guidelines. Male albino rats were administered a single dose ranging from 310, 630, 1250 and 2500 mg act. ingr./kg of butanediodic acid, sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt. All animals died within 24 hours in the 2500 mg/kg dose group, but all survived at the lower dosages. Following lethal doses, the animals exhibited profound depression and severe diarrhea prior to death. Moderate to severe irritation with haemorrhage of the gastrointestinal tract was found at post-mortem examination. At the lower dosages the animals were depressed to greater or lesser degree for 24 to 48 hours but thereafter regained normal appearance and behaviour. They were observed for a total of seven days following the dose and then sacrificed. At autopsy there was a greater than usual distension of the intestines in some instances, but otherwise no significant gross findings. The acute oral LD50 of butanediodic acid, sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt is 1750 mg/kg (ECHA) [Kl. Score=2].

Inhalation

No data available

Dermal

An acute dermal toxicity study was conducted in accordance with OECD 402 guidelines. Male albino rabbits (4 animals per dose) were administered 2.5 mL/kg, 5 mL/kg or 10 mL/kg of butanediodic acid, sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (solution containing 80% solids). The test material was administered to the closely-clipped skin in single doses under occlusive conditions for 24 hours. After exposure, the cuff and any excess of the dose were removed, and the skin examined for primary irritation. At a dosage of 10 mL/kg, there was severe erythema, edema and necrosis of the skin, and all animals died within one to three days following the removal of the dose having

exhibited extreme depression over this interval. Post-mortem examinations gave additional evidence of severe injury to the skin and abdominal wall. At the two lower dosages, there was one death each, and the LD_{50} was calculated to be 5.0 (2.6-9.6) mL/kg, or 4.0 g/kg bw of the active ingredient (ECHA) [Kl. Score=2].

D. Irritation

Skin

A skin irritation study, male albino rabbits (4 animals per dose) were administered 2.5 mL/kg, 5 mL/kg or 10 mL/kg of butanediodic acid, sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (solution containing 80% solids). The test material was administered to the closely-clipped skin in single doses under occlusive conditions for 24 hours. After exposure, the test sites were observed for 7 days for signs of irritation. At a dosage of 10 mL/kg, there was severe erythema, edema and necrosis of the skin. Post-mortem examinations gave additional evidence of severe injury to the skin and abdominal wall. At the dose of 10 mL test item/kg there was very severe erythema, oedema and necrosis of the skin. At 5 and 2.5 mL test item/kg bw, erythema and oedema were initially quite severe, but the oedema subsided within 24 to 48 hours. Erythema, however, persisted for 4 to 5 days. This material is irritating to the skin (ECHA) [Kl. Score=2].

Eye

An acute eye irritation / corrosion study was conducted in accordance with OECD 405 guidelines with male albino rabbits (5 animals per dose). Approximately 0.05 mL of butanediodic acid, sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (solution containing 80% solids) was instilled into the conjunctival sac of the left eye of each animal. The lids were held closed for about 30 seconds following introduction of the dose, and the eye was examined immediately thereafter, and again over the next several days. There was an immediate reaction of pain, but by four hours after the dose no more serious signs of irritation than profuse discharge was observed. At observation on the following day, the discharge had lessened somewhat, but a moderate degree of conjunctivitis had developed, together with extreme swelling of the lids in two instances. The intensity of these reactions was variable within the group, so that in the case of the two animals noted the severity of irritation was considerably more pronounced than with the others and, in addition, they displayed signs of corneal involvement characterized by diffuse clouding of the entire area. These differences in response are probably attributable to differences in amount of the dose washed out by the initial discharge. However, by the fourth day the pattern of injury was well-developed in all eyes and consisted of moderate discharge, partial closing of the lids by swelling, moderate conjunctivitis, sluggish reaction of the iris to light, and diffuse corneal opacity. This condition persisted with no appreciable improvement for the remainder of a 7-day observation period. There were no scores available. This test item, as a concentrated solution, is severely irritating to rabbit eyes, producing injury that is slow to heal (ECHA) [Kl. Score=2].

E. Sensitisation

A Modified Draize-Shelanski Repeat Insult Patch Test was conducted to determine the sensitisation potential of butanediodic acid, sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt. Approximately 300 mg of the test item, containing >96% active ingredient, was applied to patch sites on the backs or volar forearms of 100 subjects for ten alternate-day 24-hour periods under occlusion. Following a seven-day rest period, challenge patches of the test item were applied in the same manner to fresh sites on the backs or volar forearms of all 100 subjects for 24 hours. Challenge sites were read on

removal of the patch and 24 hours thereafter. There were no instances of irritation or sensitisation from this test item on the Draize-Shelanski Test (ECHA) [Kl. Score=2].

F. Repeated Dose Toxicity

Oral

A Combined Repeated Dose Toxicity Study with the Reproduction / Developmental Toxicity Screening Test was conducted in accordance with OECD 422 guidelines. Wistar rats were administered 100, 300, or 600 mg/kg bw/day butanediodic acid, sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt by oral gavage. Parameters measured during the study included twice a day mortality checking, daily routine and weekly detailed observation of clinical signs, weekly body weight and food consumption measurements and clinical pathology evaluation (including haematology, coagulation, clinical chemistry and urinalysis). Neurological assessment (Functional Observation Battery (FOB) including measurements of the landing foot splay, grip strength as well as locomotor activity measurement) was performed during the last week of the treatment for each sex. In summary, under the conditions of this study the daily administration of Sodium Dihexyl Sulfosuccinate by oral gavage to Wistar rats at a dose level of 100 mg solid/kg bw/day (Low dose group) did not result in test item related mortality or clinical signs. In the Mid dose group (300 mg solid/kg bw/day), most animals had minor/transient symptoms of respiratory local effects, related to reflux or by small amounts of test item reaching the upper respiratory tract area in animals; but with no indications of systemic effects of the test item. One Mid dose animal died, related to local effects of the test item. In the High dose group, the initial dose level of 1000 mg solid/kg bw/day was found to be too high despite very careful gavage procedures to ensure minimal local respiratory effects, so the dose was reduced to 600 mg solid/kg bw/day after three days of treatment. A relatively high rate of deaths or euthanasia occurred at the High dose level due to the local effects of the test item; necropsy showed local gastric irritation and respiratory effects. Test item related adverse effects were observed on body weight parameters and food consumption in High dose males and females, this was largely transient, in the first week. In High dose females there was a lower weight gain during gestation (~20% less gain than controls). There were no test-item related effects in any other measurements. Although body weight/food consumed and mortality in the High dose group were ascribed to secondary effects of the test item from the direct local effects; there could theoretically also be a potential systemic effect. Taking a conservative approach 300 mg solid/kg bw/day was applied here. The no observed adverse effect level (NOAEL) for systemic toxicity was 300 mg solid/kg bw/day (ECHA) [Kl. Score=1]**.**

Inhalation

No data available

Dermal

No data available

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on group members are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on butanedioic acid group members

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay)	-	-	1	ECHA
OECD Guideline 476 (In Vitro Mammalian Cell Gene Mutation Test)	-	-	1	ECHA
OECD Guideline 473 (In Vitro Mammalian Chromosome Aberration Test)	-	-	1	ECHA

*+, positive; -, negative

In Vivo Studies

No data available

H. Carcinogenicity

Oral

No data available

Inhalation

No data available

Dermal

No data available

I. Reproductive Toxicity

A Combined Repeated Dose Toxicity Study with the Reproduction / Developmental Toxicity Screening Test was conducted in accordance with OECD 422 guidelines. Wistar rats were administered 100, 300, or 600 mg/kg bw/day butanediodic acid, sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt by oral gavage. In addition to the parameters outlined above (Repeat Dose Oral Toxicity), the reproductive performance, pregnancy, parturition and postpartum/lactation period were monitored in the adult animals, and viability, clinical signs and development were evaluated in their F1 offspring until PND13 were also evaluated. In summary, under the conditions of this study the daily administration of this substance by oral gavage to Wistar rats at a dose level of 100 mg solid/kg bw/day (Low dose group) did not result in test item related mortality or clinical signs. No test item effect on oestrus cycle of parental females was noted. No test item related changes were noted in the reproductive parameters during mating and gestation, delivery and post-partum/lactation period until PPD14. There were no adverse effects on the F1 offspring viability, clinical signs, physical or sexual development. No test item related macroscopic finding was recorded for F1 pups at necropsy. No adverse test item related systemic macroscopic or microscopic changes were recorded at necropsy or at histopathology evaluation of routine organs/tissues or in any reproductive organs. Under the experimental conditions of this study and based on the results of thyroid hormone measurement, thyroid weights, nipple retention, anogenital distance and external reproductive organs analysis, histopathology and reproductive performance, there was no evidence

for any endocrine effects. The NOAEL for reproductive effects of the parental generation: 600 mg solid/kg bw/day (based on no significant findings). The NOAEL for pups (F1 generation) development and survival: 600 mg solid/kg bw/day (based on no significant findings) (ECHA) [Kl. Score=1].

J. Developmental Toxicity

Oral

In a developmental toxicity study (OECD 414 guidelines), pregnant Wistar rats were fed diets containing 100, 300 or 1000 mg / kg bw butanediodic acid, sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt. The animals were fed these diets from Gestation Day (GD) 6 up to and including Gestation Day (GD) 20, where sperm positive day was counted as day 0 of pregnancy (GD 0). Caesarean sections, necropsy of dams and examination of uterine contents were performed on GD 20. Dietary analysis for concentration and/or homogeneity was performed two times during the treatment period using a validated HPLC-MS method. Parameters monitored during the study included mortality and clinical observations, body weight, body weight gain and individual food consumption. Maternal reproductive parameters associated with uterine examination were evaluated, and the foetuses were weighed (anogenital distance was also determined) and examined for external, visceral and skeletal abnormalities. Placentas were examined macroscopically. Weights of selected organs of dams were recorded, and representative tissues/organs were sampled and preserved in appropriate fixatives from the adult animals. The triiodothyronine (T3), thyroxine (T4) and thyroid stimulating hormone (TSH) levels of dams were also determined. There was no clearly test item-related mortality in the study. Nevertheless, clinical signs such as hunched back (2/24) and piloerection (3/24) observed in the High dose group were related to the test item treatment and the test item related effect in the death of one High dose female (numbers) cannot be excluded. No test item effect was noted in any other parameter. One observed effect was interrupted ribs (or costal cartilage), which was significantly increased in the Low dose group compared to controls. However, there was no dose response and the incidence in the High dose group was similar to controls. Based on these data, the observed values were considered not related to the test item treatment. The following NOAEL values were derived: maternal toxicity (336.8 mg/kg bw/day), embryotoxicity (990.7 mg/kg bw/day), fetotoxicity (990.7 mg/kg bw/day), and teratogenicity (990.7 mg/kg bw/day) (ECHA) [Kl. Score=1].

Inhalation

No data available

Dermal

No data available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for group members follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

~~Oral~~

The lowest NOAEL from these studies is 300 mg/kg bw/day based on the short-term repeat dose oral toxicity study conducted on rats. The NOAEL of 300 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 300/(10 x 10 x 1 x 10 x 1) = 300/1000 = 0.3 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.3 x 70 x 0.1)/2 = 1.05 mg/L

B. Cancer

No carcinogenic studies were available. Group members are not genotoxic. Thus, a cancer reference value was not derived

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Butanedioic acid group members do not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Group members are expected to have low to moderate acute and low chronic toxicity to aquatic organisms. Aquatic organisms are most sensitive to exposure to butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt. Group members are expected to have low toxicity concern for terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on the butanedioic acid group.

Table 3: Acute Aquatic Toxicity Studies on Butanedioic Acid Group

Substance	Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Butanedioic acid, 2-sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (1:1)	*Oncorhynchus mykiss* (Rainbow trout)	96-hr LC_{50}	960	2	ECHA
	Daphnia magna (Water flea)	48-hr EC_{50}	>100	1	ECHA
	Desmodesmus subspicatus (Green algae)	72-hr EC_{50}	>100 (growth)	1	ECHA
Butanedioic acid, 2-sulfo-, 1,4-bis(2-methylpropyl) ester, sodium salt (1:1)	*Danio rerio* (Zebra fish)	96-hr LC_{50}	>900	1	ECHA
	Daphnia magna (Water flea)	48-hr EC_{50}	>898.8	1	ECHA
	Desmodesmus subspicatus (Green algae)	72-hr EC_{50}	>899.1 (growth)	1	ECHA
Butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt	*Danio rerio* (Zebra fish)	96-hr LC_{50}	49	1	ECHA
	Daphnia magna (Water flea)	48-hr EC_{50}	15.2 (geometric mean)	2	ECHA
	Desmodesmus subspicatus (Green algae)	72-hr EC_{50}	82.5 (growth)	2	ECHA

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on the butanedioic acid group.

Table 4: Chronic Aquatic Toxicity Studies on the Butanedioic Acid Group

Substance	Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Butanedioic acid, 2-sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (1:1)	*Pimephales promelas* (Fathead minnow)	28-day NOEC	≥14.8	1	ECHA
	Daphnia magna (Water flea)	21-day EC_{10}	>15	1	ECHA
	Desmodesmus subspicatus (Green algae)	72-hr EC_{10}	>100 (growth)	1	ECHA
Butanedioic acid, 2-sulfo-, 1,4-bis(2-methylpropyl) ester, sodium salt (1:1)	*Daphnia magna* (Water flea)	21-day EC_{10}	>14.2	1	ECHA
	Desmodesmus subspicatus (Green algae)	72-hr EC_{10}	>899.1 (growth)	1	ECHA
Butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt	*Daphnia magna* (Water flea)	21-day EC_{10}	9	1	ECHA
	Desmodesmus subspicatus (Green algae)	72-hr EC_{10}	22 (growth)	2	ECHA

C. Terrestrial Toxicity

In a 56-day study with *Eisenia fetida* (earthworm), stock solutions containing concentrations of 1.3, 13, 26, 52, and 104 mg/kg dw of butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt were applied to artificial soil containing Sphagnum-peat, Kaolin clay, and fine quartz-sand. The study identified a NOEC of ≥104 mg/kg dw (ECHA) [KI. Score =1].

No data are available for the other two group members.

D. Calculation of PNEC

The PNEC calculations for butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt, to which aquatic organisms are most sensitive, follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (49 mg/L), invertebrates (15.2 mg/L), and algae (82.5 mg/L). NOEC values from long-term studies are available for invertebrates (9 mg/L) and algae (22 mg/L). On the basis that the data consists of short-term results from three trophic levels and long-term results from two trophic levels, an assessment factor of 50 has been applied to the lowest reported NOEC value of 9 mg/L for invertebrates. The $PNEC_{water}$ is 0.18 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 2.68 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
= (19.08/1280) x 1000 x 0.132
= 2.68 mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
= 0.8 + [(0.2 x 38.092/1000 x 2400]
= 19.08 m^3/m^3

Where:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
= 952.3 x 0.04
= 38.092 L/kg

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt calculated from EPISUITE™ using the MCI is 952.3 L/kg.
F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are limited toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 2.29 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
= (19.046/1500) x 1000 x 0.132
= 2.29 mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
$Kp_{soil} = K_{oc} \times f_{oc}$
= 952.3 x 0.02
= 19.046 m^3/m^3

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt calculated from EPISUITE™ using the MCI is 952.3 L/kg.
F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Butanedioic acid group members are readily biodegradable and thus do not meet the screening criteria for persistence.

The measured BCF in fish is 9.33 L/kg in carp for butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt. The Log K_{ow} is <3 for other group members. Thus, butanedioic acid group members do not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on butanedioic acid group members are > 0.1 mg/L. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies on butanedioic acid group members are > 1 mg/L. Thus, butanedioic acid group members do not meet the criteria for toxicity.

The overall conclusion is that butanedioic acid, 2-sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (1:1), butanedioic acid, 2-sulfo-, 1,4-bis(2-methylpropyl) ester, sodium salt (1:1) and butanedioic acid, sulfo-, 1,4-bis-(2-ethylhexyl) ester, sodium salt are not PBT substances.

IX. CLASSIFICATION AND LABELLING

A. Classification

butanedioic acid group

Skin Irrit. Category 2, H315

Eye Dam. Category 1 H318

Only for butanedioic acid, 2-sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (1:1)

Acute Tox. (oral) Category 4, H302

B. Labelling

butanedioic acid group: Danger

C. Pictogram

butanedioic acid group



Only for butanedioic acid, 2-sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt (1:1)



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place at 15-30 ^{o}C. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

Workplace exposure standards for group members in Australia were not available.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Butanedioic acid group are not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Butanedioic acid group Listed.

XIII. REFERENCES

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BUTYL GLYCIDYL ETHER

This dossier on butyl glycidyl ether presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Butyl glycidyl ether was not identified in chemical databases used by NICNAS as an indicator that the chemical is of concern and is not a PBT substance. Butyl glycidyl ether was assessed as a tier 2 chemical for acute toxicity. No chronic aquatic toxicity data was available. Therefore, this substance is classified overall as a **tier 2** chemical and requires a hazard assessment and qualitative assessment of risk.

1 BACKGROUND

Butyl glycidyl ether has industrial uses as a viscosity reducing agent, stabiliser for chlorinated solvents, reactive diluent for epoxy resins, and as a chemical intermediate (NCBI, 2026).

Butyl glycidyl ether is not readily biodegradable. It is not expected to bioaccumulate. Butyl glycidyl ether has a low tendency to bind to soil, suspended solids or sediment.

Orally administered butyl glycidyl ether is rapidly absorbed and metabolised with most of the dose excreted in urine. It has low acute toxicity by the oral, dermal and inhalation routes. It is a skin and respiratory irritant, and has the potential to cause serious eye damage. It is a skin sensitiser. Repeated exposure inhalation studies did not cause serious systemic effects. Butyl glycidyl ether is mutagenic. There are no available carcinogenicity studies for butyl glycidyl ether.However, the induction of mutagenic effects and similarity to read-across substance allyl glycidyl ether, which is a carcinogenic substance, indicates the potential for suspected carcinogenicity. It is a potential reproductive toxicant.

The acute toxicity of butyl glycidyl ether is of low concern to aquatic organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): 2-(butoxymethyl)oxirane

CAS RN: 2426-08-6

Molecular formula: $C_7H_{14}O_2$

Molecular weight: 130.186 g/mol

Synonyms: Butyl glycidyl ether; butyl 2,3-epoxypropyl ether; oxirane, (butoxymethyl)-; 1-butoxy-2,3-epoxy-propane; n-BGE

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of butyl glycidyl ether

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Clear, colourless liquid with an irritating odour	2	ECHA
Melting Point	<-100°C @ 101.3 kPa	1	ECHA
Boiling Point	169°C @ 101.3 kPa	2	ECHA
Density	918 kg/m^3@ 20 °C	2	ECHA
Vapor Pressure	350 Pa @ 20°C	2	ECHA
Partition Coefficient (log K_{ow})	0.63 @ 25°C	2	ECHA
Water Solubility	20 g/L @ 20°C	2	ECHA
Dissociation constant (pKa)	Not available	-	ECHA
Viscosity	0.847 mPa s (predicted value using QSAR)	-	USEPA, 2026

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for butyl glycidyl ether.

NICNAS has assessed butyl glycidyl ether in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to the environment[1] .

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=8492433e-f36b-1410-8c14-0026b2c59b62

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Butyl glycidyl ether is not readily biodegradable. It is not expected to bioaccumulate. Butyl glycidyl ether has a low tendency to bind to soil, suspended solids or sediment.

B. Partitioning

Butyl glycidyl ether is highly soluble in water. Volatilisation from water and moist soil surfaces is expected to be an important fate process based upon its Henry's Law Constant (2.53 Pa m^3/mol) (ECHA). It is also expected to volatilise from dry soil surfaces based upon its estimated vapour pressure (350 Pa). Butyl glycidyl ether contains an epoxide group, which is susceptible to hydrolysis in water; however, the rate of this reaction is estimated to be very low (NCBI, 2026).

C. Biodegradation

MITI (2002) reported 40% biodegradation over 28 days in a ready biodegradation test for butyl glycidyl ether. Assuming first-order degradation kinetics, the predicted half-life in water is approximately 38 days, suggesting that butyl glycidyl ether is not persistent in water.

However, in an OECD Guideline 301D test, degradation after 28 days was approximately 25% as measured in a closed bottle test (ECHA) [KI. Score = 2]. In an OECD Guideline 301B test, degradation after 28 days was approximately 8.5% as measured by carbon dioxide production (ECHA) [KI. Score = 2]. There is some uncertainty about the low empirical biodegradation results which could be a result from volatilisation (Health Canada, 2010).

As noted above, volatilisation is expected to be an important fate process. Therefore, inherent biodegradability was assumed for this substance. If a chemical is found to be inherently biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

D. Environmental Distribution

No experimental data are available for butyl glycidyl ether. Based on an estimated soil organic carbon partition coefficient (K_{oc}) value of 50.1 L/kg (USEPA, 2026), if released to soil, the substance is expected to have low potential to adsorb to soil. If released to water, with its high solubility (20 g/L), it is also likely to not adsorb to suspended solids and sediments. The adsorptive properties of the substance are solely driven by its lipophilicity (ECHA).

E. Bioaccumulation

No experimental data are available for butyl glycidyl ether. Based on a low log K_{ow} of 0.63 and an estimated bioconcentration factor (BCF) of 7.68 L/Kg (USEPA, 2026), it has a low potential for bioaccumulation (ECHA).

6 HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Orally administered butyl glycidyl ether is rapidly absorbed and metabolised with most of the dose excreted in urine. It has low acute toxicity by the oral, dermal and inhalation routes. It is a skin and respiratory irritant, and has the potential to cause serious eye damage. It is a skin sensitiser. Repeated exposure inhalation studies did not cause serious systemic effects. Butyl glycidyl ether is mutagenic. There are no available carcinogenicity studies for butyl glycidyl ether.However, the induction of mutagenic effects and similarity to read-across substance allyl glycidyl ether, which is a carcinogenic substance, indicates the potential for suspected carcinogenicity. It is a potential reproductive toxicant.

B. Toxicokinetics

Studies have shown that orally administered butyl glycidyl ether is rapidly absorbed and metabolised (NICNAS, 2015).

Most of the dose administered to the rats was excreted in urine (84–92%) within 24 h. The rest was excreted in feces (2.6 –7.7%), expired air (0.1% volatiles and 1.5% CO2, 20 mg/kg), or remained in the tissues (1.8–4.4%) (ECHA). [Kl. Score = 2]

It was also reported that butyl glycidyl ether is readily absorbed through the skin (NICNAS, 2015).

Excretion of butyl glycidyl ether occurs mainly as urinary metabolites with up to 91.5% of the absorbed dose being excreted after 96 hours (NICNAS, 2015).

C. Acute Toxicity

Oral

In an acute oral toxicity study, butyl glycidyl ether (400, 800, 2600 or 3200 mg/kg bw) was administered intragastrically to male Princeton mice. The animals were held for a 10-day observation period after treatment, during which mortality and weight changes were recorded. Surviving and morbid animals were sacrificed for necropsy and histological examination of tissues. No deaths were observed at 400 and 800 mg/kg bw. At 1600 and 3200 mg/kg bw, 60% and 100% of the animals died, respectively. The LD_{50} was calculated to be between 1170 and 2000 mg/kg bw (ECHA). [KI score=2]

The LD_{50} value of n- butyl glycidyl ether was 2050-2500 mg/kg bw in rats and 1530 mg/kg bw in mice (NICNAS, 2015).

For read-across substance t- butyl glycidyl ether, LD_{50} values of 1530 mg/kg and >2000 mg/kg were reported for mice and rats, respectively. Rats administered with a dose of 1000 mg/kg bw via gastric intubation had slight accumulation of darkened material around the nares and slight oedema on the mucosal surface of the stomach (NICNAS, 2015).

Dermal

In an acute dermal toxicity study, butyl glycidyl ether (500, 750, or 1000 mg/kg bw) was applied topically to the skins of male and female New Zealand White rabbits under occlusive conditions for 24 hours. The topical response at the test site of application was evaluated after exposure animals were observed for 2 weeks for signs of toxicity. At 500, 750 and 1000 mg/kg bw, the mortality rate was 0%, 25% and 100%, respectively. The LD_{50} was calculated to be between 642 – 1012 mg/kg bw (ECHA). [KI score=2]

The dermal LD_{50} value of butyl glycidyl ether in rabbits was reported as 2520 mg/kg. No other study details were provided (NICNAS, 2015).

Inhalation

In an acute inhalation toxicity study, groups of male Long-Evans rats (5 per dose) were exposed to 670, 1000, 1500 or 2300 parts per million (ppm) of butyl glycidyl ether for 8 hours (whole body). At 670 ppm: No mortality occurred. At 1000 ppm, 1/5 animals died with death occurring within 16 hours. At 1500 ppm, 5/5 animals died with death occurring within 6-11 hours. At 2300 ppm, 5/5 animals died with death occurring within 1-14 days. Depression with little activity was noted in rats exposed to 670 ppm. At 1000 ppm, their activity varied from extreme apathy to agitation and leaping. The LC_{50} level was determined to be 1030 ppm (or 10,970 mg/m^3) (ECHA). [KI score=2].

Reported effects from vapour exposure to butyl glycidyl ether included delirium, depression, dyspnoea, lacrimation, salivation, nasal discharge, and aerophagia (excessive air swallowing which goes to the stomach). Limited information indicated that exposure to read-across substance t- butyl glycidyl ether vapours up to seven hours did not cause any signs of toxicity in female rats at concentrations of up to 3333 ppm (equivalent to 17,730 mg/m^3). However, exposure to t-butyl glycidyl ether at a concentration of 16 180 ppm (equivalent to 86,090 mg/m^3) caused deaths of 80% of the dose group (NICNAS, 2015).

D. Irritation

Skin

To evaluate the primary irritation potential of butyl glycidyl ether, 0.5 mL of the undiluted test material was applied to the shaved backs (intact and abraded) of 6 New Zealand White rabbits. Exposure duration was 24 hours under occlusive conditions. The animals were observed for 72 hours post-exposure and score for irritation at 0, 24 and 72 hours. At 4 hours, there was negative to moderate irritation on intact skin and moderate to severe irritation on abraded skin, with no eschar present. At 24 hours, there was moderate irritation on intact skin and severe irritation on abraded skin, with beginning eschar barely discernible in 2/6 rabbits. At 72 hours, there was slight to severe irritation on intact skin and severe irritation on abraded skin, with eschar present in 5 animals. The primary irritation score was 4.3 which classifies the substance as severely irritating. Escharotic for abraded skin (ECHA). [KI score=2]

Experimental studies on the skin of New Zealand White rabbits caused mild irritation (score of 2.8 on the Draize scale) after 24- and 48-hour occlusive treatments. Moderate irritation (score of five on

the Draize scale) was observed when butyl glycidyl ether (0.01 mL undiluted) was applied to covered abdominal skin of rabbits after 24 hours (NICNAS, 2015).

Eyes

In two eye irritation studies, 0.1 ml of undiluted butyl glycidyl ether was instilled into the eyes of New Zealand White rabbits without rinsing. In the first test, the effects observed in the eye of one animal were fully reversed within three days and of the other two animals in seven days. In the second test, the effects observed in the eye of 2 animals were fully reversed within 4 days. The third animal showed severe ocular damage. This was not cleared after 3 days and judged to be irreversible damage. Under these test conditions, butyl glycidyl ether is considered to be a moderate to severe eye irritant (ECHA). [KI score=2]

Several eye irritation studies have reported that undiluted butyl glycidyl ether caused eye irritation at doses ranging from 0.005 mL to 0.1 mL (NICNAS, 2015).

E. Sensitisation

The skin sensitising potential of butyl glycidyl ether was evaluated in the guinea pig maximisation test. Of the 12 animals exposed to the test substance 6 became positive. Of the 12 control animals, none reacted to any of the four substances tested. Based on these results, butyl glycidyl ether was determined to be sensitising to the skin (ECHA). [KI score=2]

Based on additional experiments conducted in guinea pigs, intracutaneous and topical application of butyl glycidyl ether was demonstrated to cause sensitisation in >50% of the dosed animals (NICNAS, 2015).

In a human patch test, five out of 25 volunteers exposed to 1.25% of butyl glycidyl ether tested positive for sensitisation effects. This result was also evident in another study where 19 out of 24 volunteers tested positive for sensitisation to butyl glycidyl ether (1 mL of a 10% solution) (NICNAS, 2015).

F. Repeated Dose Toxicity

Oral

No data available

Dermal

A limited study conducted in five rabbits reported small, white lesions in the liver following dermal application of butyl glycidyl ether five times per week, for four weeks (NICNAS, 2015).

Inhalation

In a subchronic repeat-dose inhalation toxicity study, male rats were exposed to butyl glycidyl ether vapours for seven hours per day, five days per week for ten weeks, a dose of 300 ppm (equivalent to 1,600 mg/m^3). Exposure at 300 ppm caused an increase in mortality (50%), emaciation, liver necrosis, rough appearance, and significant increases in kidney:body weight and lung:body weight

ratios. Growth retardation was observed in the 150 ppm group (equivalent to 800 mg/m^3). The NOAEC was determined to be 38 ppm (200 mg/m^3) based on severe pneumonia and slight patchy atrophy of the testis (ECHA).[KI score =2].

In an OECD Guideline 412 (Subacute Inhalation Toxicity: 28 day) study, male and female C-G TIF:RAIF rats (10 rats per sex per dose) were exposed (vapor, nose only) to three concentrations of butyl glycidyl ether (1 mg/L, 0.5 mg/L and 0.1 mg/L) for the 28-day exposure of 6 hours per day, 5 days per week. A reversibility group of 5 animals per sex in the control group and 5 in the high dose group was also included. The exposures resulted in decreased body weights in the high dose groups, changes in fasting glucose in the high dose reversibility group, elevated aspartate transferase levels in serum of high dose males and slightly increased haemoglobin in high dose male animals which was reversible. Some changes were also seen in the blood lymphocytes. Histopathological examination revealed a degeneration of the olfactory mucosa and hyperplastic/metaplastic changes of the ciliated respiratory epithelium; both changes were more apparent in males than in females. These changes were present in the high and medium dose groups but not in the low dose group. Based on the later effects observed, the NOAEC was determined to be 0.1 mg/L (100 mg/m^3). (ECHA).[KI score =2].

G. Genotoxicity

In Vitro Studies

As summarised in Table 3, the substance was demonstrated to induce mutations in Salmonella typhimurium strain TA 1535 and TA 100 with and without the presence of a metabolic activations system. The substance was also shown to be positive in an unscheduled DNA synthesis test in the presence of metabolic activation and in a mouse lymphoma assay without metabolic activation and with a non-induced S-9 mix (ECHA).

Table 3 *In vitro* Genotoxicity Studies on butyl glycidyl ether

Test System	Results		Klimisch Score	Reference
	-S9	+S9		
Bacterial reverse mutation (*S. typhimurium* strains TA 1535, TA 1537, TA 98 and TA 100)	+ (in strains TA 100 and TA 1535)	+ (in strains TA 100 and TA 1535)	2	ECHA
Unscheduled DNA synthesis (UDS) assay in mouse lymphoma cells and in human erythrocytes	-	+	2	ECHA
Gene mutation study in mammalian cells (L5178Y mouse lymphoma assay)	+	+	2	ECHA

*+, positive; -, negative

In addition, butyl glycidyl ether tested positive for mutagenicity in the following additional tests: SOS chromotest in E. coli PQ37; sister chromatid exchange assay in CHO cells; and, dominant lethal assay in rats (NICNAS, 2015).

In Vivo Studies

In an *in vivo* mammalian somatic cell study: cytogenicity / bone marrow chromosome aberration study, male and female Sprague-Dawley rats received daily intraperitoneal doses of butyl glycidyl ether at levels of 31.3, 104.2 and 312.5 mg/kg bw per day for 5 days. On Day 6, all animals received an intraperitoneal injection of colchicine (2.0 mg/kg body weight) to inhibit mitosis in dividing cells. Approximately two to four hours after injection of colchicine, the animals were sacrificed and the bone marrow cells were analysed for the presence of aberrant cells. Analysis of marker aberrations resulted in a significant elevated mid-dose group. The low- and high-dose groups were elevated with respect to the incidence of severely damaged cells. The percent of aberrant cells (total number of aberrant cells per animal) was significantly increased among all treated groups when compared to the negative control. Therefore, under the conditions of this study, butyl glycidyl ether administered intraperitoneally for five consecutive days at doses as low as 31.3 mg/kg bw/day resulted in structural chromosomal aberrations in the rat bone marrow cells at all levels (ECHA). [KI score=2]

Butyl glycidyl ether produced positive results in a dominant lethal test in rats with increased foetal mortality, reduced number of pregnancies and possible implantation losses. Positive results were also observed in a micronucleus test. However, results of a host-mediated assay, testing mouse urine in *S. typhimurium* were negative (NICNAS, 2015).

H. Carcinogenicity

In a two-year inhalation study conducted in Osborne-Mendel rats and B6C3F1 mice (50 animals/sex/dose), read-across substance allyl glycidyl ether (at concentrations of up to 100 ppm (equivalent to 0.467 mg/L)) caused tumours in the nasal passages of both species which includes epithelial adenocarcinomas, papillary adenomas, harderian gland adenomas, and squamous cell carcinomas. No deaths occurred in either rat or mouse study. There were also no significant differences in body weight gain between the exposed groups and the control group (NICNAS, 2015).

There are no available carcinogenicity studies for butyl glycidyl ether.However, the induction of mutagenic effects (see prior Genotoxicity section) and similarity to read-across substance allyl glycidyl ether, which is a carcinogenic substance, indicates the potential for suspected carcinogenicity (NICNAS, 2015).

I. Reproductive and Developmental Toxicity

In an inhalation study conducted in rats exposed to butyl glycidyl ether vapours, testicular atrophy was observed at concentrations of 400 mg/m^3 and above (NICNAS, 2015).

No other reproductive toxicity studies and no developmental toxicity studies were identified for butyl glycidyl ether.

In OECD Guideline 421 (Reproduction / Developmental Toxicity Screening Test) conducted on read-across substance allyl glycidyl ether (CAS RN 106-92-3), Osborne-Mendel rats (20 animals/sex/dose) were exposed to read-across substance allyl glycidyl ether (CAS RN 106-92-3) at vapour concentrations of 0, 30, 100 or 200 ppm (equivalent to 140, 467, and 933 mg/m^3) for six hours per day, five days per week. Groups of 20 B6C3F1 mice of each sex were exposed to air containing the test item (source substance) at target concentrations of 0, 4, 10, or 30 ppm (equivalent to 19, 47 and

140 mg/m^3)on the same schedule. Mating occurred two days after the eight-week exposure period. Mortalities occurred in the high dose groups before the end of the eight-week exposure period (two out of 20 males). Based on the results of the experiment, the mating performance of exposed male rats was markedly reduced; however, sperm motility and number were not affected. The reproductive performance of males exposed to 200.0 ppm was found to be markedly impaired. Small but statistically significant reductions were seen in the number of corpora lutea per dam and in the number of implantation sites per dam in females exposed to 200 ppm. The number of implantation sites per dam were statistically significant reduced when the in groups where males were exposed starting from 30 ppm. The number of pregnant females was statistically significantly reduced in groups where males were exposed starting from 30 ppm. The number of live pups sired by any group of exposed males was significantly lower than that sired by controls. No deficiencies were seen in the reproductive performance of exposed female rats or male or female mice. The inhalation of the test item (source substance) apparently has little potential for direct effect on reproduction in mice. Based on this the NOAEC for developmental toxicity was determined to be <140 mg/m^3 (<30 ppm) and 140 mg/mg^3 (30 ppm), for rats and mice respectively (ECHA). [Kl. Score = 2]

J. Derivation of Toxicological Reference and Drinking Water Guidance Values

No suitable data are available to derive toxicological reference and drinking water guidance values for butyl glycidyl ether.

K. Human Health Hazard Assessment of Physico-Chemical Properties

Butyl glycidyl ether does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidizing potential

7 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

The acute toxicity of butyl glycidyl ether is of low concern to aquatic organisms. No chronic studies are available for aquatic organisms. No studies are available for terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 4 lists the results of acute aquatic toxicity studies conducted on butyl glycidyl ether.

Table 4: Acute Aquatic Toxicity Studies on Butyl Glycidyl Ether

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Oncorhynchus mykiss (Rainbow trout)	96-hr LC_{50}	65	2	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	9.2	2	ECHA

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Raphidocelis subcapitata (Green alga)	96-hr EC_{50}	35 (growth)	2	ECHA

Chronic Studies

No chronic studies are available for butyl glycidyl ether.

C. Terrestrial Toxicity

No studies are available for butyl glycidyl ether.

D. Calculation of PNEC

The PNEC calculations for butyl glycidyl ether follow the methodology discussed in DEWHA (2009).

PNEC water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (65 mg/L), invertebrates (9.2 mg/L) and algae (35 mg/L). No chronic studies are available. On the basis that the data consists of short-term studies for three trophic levels and no long-term results are available, an assessment factor of 1,000 has been applied to the lowest reported EC_{50} of 9.2 mg/L for invertebrates. The $PNEC_{water}$ is 0.0092 mg/L.

PNEC sediment

There are no toxicity data for sediment-dwelling organisms. Moreover, the substance is not expected to substantially partition to sediments. Nonetheless, a $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 0.013 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= 1.762/1280 \times 1000 \times 0.0092$
$= 0.013$ mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 kg/m^3[default]
$PNEC_{water}$ = 0.0092 mg/L

$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 2.00)/1000 \times 2400]$
$= 1.762\ m^3/m^3$

And:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 kg/m^3[default]

$Kp_{sed} = K_{oc} \times f_{oc}$
= 50.1 x 0.04
= 2.00 L/kg

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for butyl glycidyl ether is 50.1 L/kg (USEPA, 2026).
f_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC soil

There are no toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 0.0061 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
= (1.00/1500) x 1000 x 0.0092
= 0.0061 mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 kg/m^3 [default]

$Kp_{soil} = K_{oc} \times f_{oc}$
= 50.1 x 0.02
= 1.00 m^3/m^3

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for butyl glycidyl ether is 50.1 L/kg (USEPA, 2026).
f_{oc} = fraction of organic carbon in soil = 0.02 [default].

8 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REAC Criteria methodology (IChEMS, 2022; ECHA, 2023).

Butyl glycidyl ether is inherently biodegradable; thus, it does not meet the screening criteria for persistence.

Based on a measured log K_{ow} of 0.63, butyl glycidyl ether does not meet the screening criteria for bioaccumulation.

There are no chronic studies on butyl glycidyl ether. The acute E(L)C_{50} values are >1 mg/L in fish, invertebrates and algae. Thus, butyl glycidyl ether does not meet the screening criteria for toxicity.

The overall conclusion is that butyl glycidyl ether is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for butyl glycidyl ether. .

9 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
Butyl glycidyl ether	2426-08-6	Not a PBT	No	No	No	No	No	No	2	No Data	2

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 2 - Hazard Assessment and Qualitative Assessment Only. Develop toxicological profile and PNECs for water and soil and provide qualitative discussion of risk.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

10 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

%	percent
°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
BCF	bioconcentration factor
COC	constituent of concern
DEWHA	Department of the Environment, Water, Heritage and the Arts
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
HHRA	enHealth Human Risk Assessment
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
KI	Klimisch scoring system
kPa	kilopascal
L	litre
L/kg	litres per kilogram
LC	lethal concentration
LD	lethal dose
LOAEL	lowest observed adverse effect level

m^3	cubic metre
mg/kg	milligrams per kilogram
mg/L	milligrammes per litre
mg/m^3	milligrams per cubic metre
mL	millilitre
mPa s	millipascal second
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
NOAEC	no observed adverse effect concentration
NOAEL	no observed adverse effect level
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RfD	Reference Dose
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

BUTYLATED HYDROXYTOLUENE

This dossier on butylated hydroxytoluene presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): 2,6-Di-tert-butyl-4-methylphenol

CAS RN: 128-37-0

Molecular formula: $C_{15}H_{24}O$

Molecular weight: 220.356 g/mol

Synonyms: butylated hydroxytoluene, p-Cresol, 2,6-di-tert-butyl-, Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl-

SMILES: CC1=CC(=C(O)C(=C1)C(C)(C)C)C(C)(C)C

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of Butylated hydroxytoluene

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Colourless crystalline powder	2	ECHA
Melting Point	69.8°C @ 101.3 kPa	2	ECHA
Boiling Point	265°C @ 101.3 kPa	2	ECHA
Density	1030 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	1.1 Pa @ 20°C	2	ECHA
Partition Coefficient (log K_{ow})	5.1 @ 20°C	2	ECHA
Water Solubility	0.00076 g/L @ 20°C	2	ECHA
Flash Point	127°C	2	ECHA
Auto flammability	No spontaneous combustion (tested up to 400°C)	2	ECHA
Viscosity	Study not feasible	-	ECHA
Henry's Law Constant	179.3 Pa m^3/mol @ 12°	2	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Butylated hydroxytoluene is not expected to be readily or inherently biodegradable. It has a moderate potential for bioaccumulation. It is expected strongly adsorb to soil and sediment. However, volatilisation is an important transport pathway from both soil and water.

B. Biodegradation

Butylated hydroxytoluene is neither readily biodegradable nor is there a clear indication of inherent biodegradability. In an unadapted mixed microbial inoculum study, 4.5% of degradation was identified after 28 days. In an aquatic model ecosystem study with radiolabelled butylated hydroxytoluene, recovery of ^{14}C was 40 to 50% after 28 days (ECHA). [Kl. Score = 2].

If a chemical is found to be not readily or inherently biodegradable, it is categorised as Persistent since its half-life is substantially less than 60 days (DoEE, 2017). However, according to simulation tests in surface water (OECD 309) and in soil (OECD 307), the parent substance degrades with a half life of 8.6 days in water and 0.6 days in soil (both values at 12°C) (ECHA).

C. Environmental Distribution

Based on a log soil organic carbon coefficient of (K_{oc}) of 3.9 (K_{oc} of 8,183 L/kg), butylated hydroxytoluene is expected to strongly adsorb to soil and sediment. If released to water, based on its solubility and Henry's law constant, it is expected to volatilise rapidly. It also has the potential to volatilise from moist soil surfaces (ECHA).

D. Bioaccumulation

Butylated hydroxytoluene has a moderate potential to bioaccumulate. A bioconcentration study with *Cyprinus carpio* was conducted by MITI in 1992 to measure a bioconcentration factor (BCF) of 2,6 -di-tert-butyl-p-cresol (BHT) in the aquatic environment. This test was performed in accordance with the national Japanese guidance "Bioaccumulation test of chemical substance in fish and shellfish" stipulated in the Japanese Order Prescribing the Items of the Test relating to the new chemical substance (1974). This guideline corresponds to OECD guideline 305C. A bioconcentration factor of 1,277 was determined (ECHA). [Kl. Score = 2]

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Following exposure, the liver and lungs metabolize BHT by hydroxylating its alkyl substituents and further conjugation to become water-soluble. This material is mildly acutely toxic through the oral route. BHT is a skin and eye irritant but it is not a skin sensitiser. Repeated dose toxicity demonstrated the potential for adverse effects to the liver. This material does cause reproductive or developmental toxicity. BHT is not a carcinogen and non-genotoxic.

B. Metabolism

Following exposure, the liver and lungs metabolize BHT by hydroxylating its alkyl substituents. (i.e., tert-butyl groups). These hydroxylated metabolites are then conjugated with sulfate and glucuronic acid to become water-soluble and excreted.

C. Acute Toxicity

Oral

In an acute oral toxicity study, single oral doses of 500 and 1000 mg/kg BHT were given to Fischer 344 rats. In males, the high dose caused renal and hepatic damage, decreased the accumulation of p-aminohippuric acid in renal slices, and proteinuria and enzymuria. No mortality was reported (CIR).

In another acute oral toxicity study, male Sprague-Dawley rats were given a single, oral dose of 800 mg/kg BHT and were sacrificed at 0.5, 3, 6, 12, 24, 48, 60, and 72 hours after dosing. The concentrations of blood coagulation factors and the hepatic concentrations of BHT were determined. Body weight gain was reduced at 24 to 72 hours after BHT administration, but relative liver weights were significantly larger than controls at 36 to 72 hours. No necrotic changes were observed. Coagulation factors II, VII, IX, and X were decreased 36 hours after BHT administration, and all reached a minimum 48 to 60 hours after BHT administration. Hepatic concentrations of BHT peaked at 3 hours, whereas BHT quinone methide peaked at 24 hours. No mortality was reported (CIR).

D. Irritation

Skin

BHT (100%) was applied to the skin of rabbis during a 48-hour patch test and produced moderate irritation (CIR).

In a 48-hour human patch test, pure BHT elicited positive irritation reactions in 71% of the subjects and 29% had slight irritancy reactions. The investigators concluded that BHT was a mild irritant (CIR).

E. Sensitisation

In a 48-hour human patch test, pure BHT elicited sensitisation reactions in 19% of the subjects. The investigators concluded that BHT was a moderate sensitiser but it does not meet the classification (CIR).

F. Repeated Dose Toxicity

Oral

In a 16-week feeding study using Carworth SPF rats, 0.1% BHT increased the daily urinary elimination of ascorbic acid and induced liver enlargement, particularly in females. These parameters returned to control values by the end of the study. BHT also increased renal weight, and it did not induce hepatotoxicity (CIR).

In another repeat dose oral toxicity study, male Wistar rats were fed a diet containing 13% proteins and 11% lipids (peanut oil) for 21 weeks. Over that period, the concentration of BHT in the feed was increased weekly from 0.1% to 2.1%. When the diet was supplemented with 0.1% BHT, feed intake was limited but stabilized at concentrations <1.2%. When the rats were treated with >1.3 BHT, feed intake decreased as a decreasing hyperbolic function of the increased dose. Body weights increased when the rats were treated with <0.5% and were stable from 0.6% to 0.9% BHT. At concentrations of 1% to 1.2% BHT, body weights decreased rapidly. These results indicated that 1.3% BHT (300 mg/kg/day) was the maximum amount the male rat could “process” when fed 13% protein and 11% lipids. When the protein concentration was increased to 19.5% to 26%, the feed intake and

bodyweight of rats fed 2.1% BHT increased and stabilized; rats fed 26% protein could process up to 630 mg/kg/day BHT.

Inhalation

No data available

Dermal

No data available

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on Butylated hydroxytoluene are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on Butylated hydroxytoluene

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial Reverse Mutation Assay	-	-	-	CIR
Chromosome Aberration Assay	-	-	-	CIR
Sister-chromatid Exchange Assay	-	-	-	CIR
DNA Cleavage Assay	-	-	-	CIR

*+, positive; -, negative

In Vivo Studies

Host-mediated assays in mice using *S. typhimurium* were negative (CIR).

H. Carcinogenicity

Oral

In a 22-month two generation carcinogenicity study with Wistar rats, BHT was contained in the diet at concentrations of 0, 25, 100 and 500 mg/kg bw/day. An enlargement of the livers was found in lactating dams of the highest dose group (500 mg/ kg bw/day); in addition morphological evidence of metabolic activity were seen. The histological and biochemical changes seen in the F1 generation were similar to those reported by other workers on the hepatic effects of BHT and are consistent with the effects of an inducer of cytochromes P450. The nodules and glucose 6 -phosphatease deficient altered hepatic foci observed at the time point of 22 month post-weaning were probably induced by BHT. No evidence of thyroid increased activity as a result of BHT administration was observed at a dose level of 25 mg/kg bw/ day. Thyroid hyperactivity occurred at dose levels of 100 and 250 mg/kg bw/ day. It appeared that BHT gave some protection against the development of chronic progressive nephropathy (CNP), because CPN was observed in all rats (incl. controls) at every time point, but the disease was less severe in rats treated with 250 mg/kg bw day. No adverse effect of BHT was observed in the adrenals. A no observed adverse effect level (NOAEL) of 25 mg/kg bw/day was determined based on increase liver enzymes in male rats (ECHA). [Kl. Score = 2]

During an oral carcinogenesis assay, 1% and 2% concentrations of BHT were added to the feed of B6C3F1 mice for 104 weeks. The mice were examined for signs of tumorigenesis at 16 weeks after the BHT feeding period. The control group and two treatment groups were each comprised of 50 mice/sex. The average daily intakes of BHT were 59 and 57 mg/day for males and females fed 1% BHT, respectively, and were 116 and 118 mg/day for males and females of the high-dose group. Males had a dose-related change in survival throughout the study, but no difference in survival occurred between treated and control females until week 88, when the survival of BHT-treated mice increased compared to controls. At week 104, the percent survivals for males were 74% (high-dose), 64% (low-dose), and 40%(control). For females, the values were 89%, 81%, and 58%, respectively. Of the mice, 89% of BHT-treated males, 64% of control males, 91% of BHT-treated females, and 82% of female controls were considered effective and incorporated into the results. Females treated with BHT had a significantly decreased incidence of neoplasms compared to controls, and the survival time of mice with neoplasms was increased. Survival times of males did not differ between treatment and control groups. The control incidences of neoplasms were 84% in males and 85% in females, and mice of this group survived for an average of 108 to 109 weeks. For mice of the low-dose group, 86% and 75% of males and females had neoplasms, respectively. The mean survival times were 110and 114 weeks, respectively. For males and females of the high-dose group, 81% and 55% had neoplasms, respectively. The mean survival times were 114 and 118 weeks, respectively. Neoplasms of the liver, lungs, hematopoietic system, integumentary system, reproductive system (females), pancreas, oesophagus, and small intestine were detected; however, only the incidence of hepatocellular adenomas in males of the high-dose group was significant (CIR).

Inhalation

No data available

Dermal

No data available

I. Reproductive Toxicity

The reproductive and developmental toxicity potential of BHT was evaluated using pregnant CD-1 mice. On gestational days (GDs) 6 to 15, the dams were treated with 180 mg/kg/day of the test material via oral intubation. Body weights were recorded on GDs 0, 6, 11, 15, and 17. Offspring were delivered on GD 17 via caesarean section, and the numbers of implantation sites, resorption sites, and live and dead foetuses, as well as the body weights of the live pups, were recorded. The urogenital tract of each dam was also examined for lesions of toxicity, and the foetuses were examined for gross, skeletal, and visceral abnormalities. Under the conditions of this study, BHT had no adverse reproductive or developmental effects. Therefore, the NOAEL was >180 mg/kg bw/day (CIR).

J. Developmental Toxicity

Oral

In developmental toxicity study, 12 to 18 pregnant Dutch belted rabbits per group were treated with BHT via oral intubation on GDs 6 to 18. The doses were 3.20, 14.9, 69.1, and 320.0 mg/kg BHT. The positive control was 2.5 mg/kg6-aminonicotinamide, which was administered on GD 9. Body weights were recorded on GDs 0, 6, 12, 18, and 29, and the dams were observed daily for appearance and behaviour. On GD 29, the offspring were delivered by caesarean section, and the numbers of corpora lutea, implantation sites, resorption sites, and live and dead foetuses were determined. One

dam of the control group and three, four, and three dams of the 14.9-, 69.1-, and 320.0-mg/kg dose groups, respectively, died or aborted before GD 29. The live pups were weighed, killed, and examined for external, visceral, and skeletal abnormalities. The ratio of resorptions to the number of implantation sites per dam was increased in the test groups compared to the sham control group, but the number of skeletal and visceral abnormalities was not significantly different. It was concluded that BHT was nonteratogenic, although it caused systemic toxicity. The NOAEL was >320 mg/kg bw/day for teratogenicity. (CIR).

A multigeneration reproductive and developmental toxicity study using Crj:CD-1 mice were performed. Ten mice per sex per group were fed 0.015%, 0.045%, 0.135%, or 0.405% BHT or a control diet from 5 weeks of age of the F0 generation to the weaning of the F2 generation. During the second week of lactation, one dam died in each of the 0.015% (F0), 0.045% (F0), and0.015% (F1) test groups. No consistent significant effect was observed on the number of litters, sex ratio, litter size, or litter weight at birth for each generation. Increased litter weights were reported at birth and during lactation for pups of the 0.015% groups and during lactation for F2 pups of the other treatment groups. Neurobehavioral parameters were not statistically different from controls with the exceptions of increased incidences of surface righting at postnatal days (PNDs) 7 and 4 in the F1 and F2 generations, respectively, and negative geotaxis at PND 7 in the F2 generation. It was concluded that 0.015% to 0.405% BHT had little adverse effect on reproductive and neurobehavioral parameters in mice (CIR).

In another study, Wistar rats were fed diets of 500 mg/kg/day (0.5% to 0.9% of the diet) BHT from 6 weeks of age of the F0 to the weaning of the F1 generation. The F0 generation consisted of 46 rats per sex; 40 litters/group were produced. Bodyweights of F0 males and females were decreased significantly compared to controls. During the first 7 days of gestation, test females had significantly decreased bodyweight gain that persisted throughout gestation. The duration of pregnancy, average birth weight, and average litter size did not differ among groups, but a slightly decreased proportion of females/litter was reported. Half of the litters were cofostered such that non-dosed dams nursed pups of dosed dams, and vice versa. Pups of dosed dams suckled by non-dosed dams had a slightly, relatively slower development than pups of the control group. Pups nursed by dosed dams had delayed development, decreased body weight, and decreased weight gain, as well as hyperactive behaviour when handled during the first week of lactation. At microscopic examination of the brain, slightly increased incidences of the average number of dead cells were observed in the cerebellum of pups suckled by dosed dams. It was concluded that the effect on F1 offspring was due to a decreased nutrition from BHT's influence on the lactation of the F0 females, influence on the suckling ability of the F1 rats or both in combination. The NOAEL was <500 mg/kg bw/day (CIR).

Inhalation

No data available

Dermal

No data available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for Butylated hydroxytoluene follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

The lowest NOAEL from these studies is 25 mg/kg bw/day based on the two generation carcinogenicity study conducted on rats. The NOAEL of 25 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 1
UF_D (database uncertainty) = 1
Oral RfD = 25/(10 x 10 x 1 x 1 x 1) = 25/100 = 0.25 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.25 x 70 x 0.1)/2 = 0.875 mg/L

B. Cancer

Studies suggest that BHT is not carcinogenic. EFSA evaluated historical and contemporaneous studies and determined that the effects of BHT on tumour formation reported in the 1986 Olsen et al. study (cited in ECHA) are subject to a threshold since the genotoxicity studies generally indicate a lack of potential for BHT to induce point mutations, chromosomal aberrations, or to interact with or damage DNA (ECHA). Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Butylated hydroxytoluene does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Butylated hydroxytoluene is expected to have high acute and chronic toxicity to aquatic organisms. It is expected to have low chronic toxicity to terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on butylated hydroxytoluene.

Table 3: Acute Aquatic Toxicity Studies on Butylated Hydroxytoluene

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Brachydanio reria (zebrafish)	96-hr LC_{50}	0.57	2	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	0.48*	1	ECHA
Desmodesmus subspicatus(Green algae)	72-hr EC_{50}	>0.4 (growth)	2	ECHA

Note: * = median value

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on butylated hydroxytoluene.

Table 4: Chronic Aquatic Toxicity Studies on Butylated Hydroxytoluene

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Oryzias latipes (Japanese medaka fish)	30-day NOEC	0.053	2	ECHA
Daphnia magna (Water flea)	21-day NOEC	<0.39	2	ECHA
Desmodesmus subspicatus(Green algae)	72-hr EC_{10}	0.4	2	ECHA

C. Terrestrial Toxicity

The lowest NOEC was found in the long-term plant study, at 4.74 mg/kg soil dw. According to REACH guidance document, this result shall be normalised based on a standard soil with an organic matter content of 3.4%. The soil used in this plant test contained 0.68% organic carbon which is recalculated to organic matter by a factor of 2 (1.36%). Thus, the NOEC based on standard soil is 4.74 *3.4/1.36 mg/kg s.w. = 11.85 mg/kg d.w (ECHA). [Kl. Score = 1]

D. Calculation of PNEC

The PNEC calculations for butylated hydroxytoluene follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (0.57 mg/L), invertebrates (0.48 mg/L), and algae (>0.4 mg/L). NOEC values from long-term studies are available for fish (0.053 mg/L), invertebrates (0.39 mg/L) and algae (0.4 mg/L). On the basis that the data consists of short-term and long-term results from three trophic levels, an assessment factor of 10 has been applied to the lowest reported NOEC value of 0.053 mg/L for fish. The $PNEC_{water}$ is 0.0053 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 0.65 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (157.91/1280) \times 1000 \times 0.0053$
$= 0.654$ mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 327.32/1000 \times 2400]$
$= 157.91\ m^3/m^3$

Where:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
$= 8,183 \times 0.04$
$= 327.32$ L/kg

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for butylated hydroxytoluene calculated from EPISUITE™ using the MCI is 8,183 L/kg.
F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are limited toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 0.58 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
= (163.66/1500) x 1000 x 0.0053
= 0.58 mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
$Kp_{soil} = K_{oc} \times f_{oc}$
= 8,183 x 0.02
= 163.66 m^3/m^3

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for butylated hydroxytoluene calculated from EPISUITE™ using the MCI is 8,183 L/kg.
F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Butylated hydroxytoluene is not readily or inherently biodegradable and thus does meet the screening criteria for persistence. However, it does exhibit rapid degradation in environmental systems.

A BCF of 1,277 was measured in carp. Thus, butylated hydroxytoluene does not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on butylated hydroxytoluene are < 0.1 mg/L for fish. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies on butylated hydroxytoluene are < 1 mg/L in fish, invertebrates and algae. Thus, butylated hydroxytoluene does meet the criteria for toxicity.

The overall conclusion is that butylated hydroxytoluene is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Aquatic Chronic Category 1, H410

B. Labelling

Warning

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses if easily possible. Seek medical attention even if there are not any symptoms.

Skin Contact

Remove contaminated clothes. Rinse. Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical. In case of fire, keep drums cool by spraying with water.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas. If material or runoff enters waterways, notify downstream users of potentially contaminated waters.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

Remove all ignition sources.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place. Keep separated from strong oxidants and strong bases.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

The workplace exposure standards for butylated hydroxytoluene in Australia is as follows: time weighted average 10 mg/m^3.

Engineering Controls

Good general ventilation should be used. Prevent dispersion of dust.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Butylated hydroxytoluene is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Wastewater should be contained and evaluated for subject chemical or decomposition product concentrations. Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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EHS Support

CALCINED PETROLEUM COKE

This dossier on calcined petroleum coke presents the most critical studies pertinent to the risk assessment of calcined petroleum coke in its use in coal seam gas extraction activities. It does not represent an exhaustive or critical review of all available data. The information presented in this dossier was obtained from the American Petroleum Institute (API) Test Plan and Robust Summaries on Petroleum Coke submitted to the United States Environmental Protection Agency (USEPA) High Production Volume Information System (HPVIS) Chemical Challenge Program (API, 2000; API, 2008). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Calcined petroleum coke is classified as a tier 1 chemical and requires a hazard assessment only.

1 BACKGROUND

Calcined petroleum coke is a black-coloured solid produced by the high-pressure thermal decomposition of heavy (high-boiling) petroleum process streams and residues. If released to the environment, petroleum coke is expected to be chemically and physically inert. Calcined petroleum coke is not expected to biodegrade since it is composed mainly of elemental carbon, which does not contain the chemical bonds that microbes require for metabolism. Being water-insoluble and physically and biologically inert, calcined petroleum coke is not expected to bioaccumulate. It is of low toxicity concern to aquatic and terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Coke (petroleum), calcined

CAS RN: 64743-05-1

Molecular formula: Not Applicable, UVCB

Molecular weight: Not Applicable, UVCB

Synonyms: Coke (petroleum), calcined; coke, petroleum, calcined

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Calcined Petroleum Coke

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Black-coloured solid	-	API, 2008; USEPA, 2011
Melting Point	Not applicable	-	API, 2008; USEPA, 2011
Boiling Point	Not applicable	-	API, 2008; USEPA, 2011
Density	700-950 kg/m^3	-	API, 2000
Vapor Pressure	Negligible	-	API, 2008; USEPA, 2011

Property	Value	Klimisch Score	Reference
Partition Coefficient (log K_{ow})	Not applicable	-	API, 2008; USEPA, 2011
Dissociation Constant (pKa)	Not applicable	-	USEPA, 2011
Water Solubility	Insoluble	-	API, 2008; USEPA, 2011
Viscosity	Not applicable, substance is a solid	-	-

Petroleum coke consists of two substances: green coke and calcined coke. The principal difference between the substances is the amount of residual hydrocarbon in the two products. Petroleum coke (both green and calcined) is produced by the high-pressure thermal decomposition of heavy (high-boiling) petroleum process streams and residues. Green coke is the initial product from the cracking and carbonisation of the feedstocks to produce a substance with a high carbon-to-hydrogen ratio. Green coke undergoes additional thermal processing to produce calcined coke. The additional processing removes the residual hydrocarbons and increases the percentage of elemental carbon, which results in a lower potential for toxicity (API, 2008).

Green petroleum coke exists as a solid substance composed of predominantly carbon in a polycrystalline porous matrix. Approximately 9-21% by weight of green petroleum coke is volatile matter that is driven off during the calcining process. This volatile matter consists of the heavy hydrocarbons remaining from the feedstocks that have not undergone complete carbonisation. It exists in green coke as a hardened residuum in the carbon matrix. The specific chemical composition of any given batch of petroleum coke is determined by the composition of the feedstocks used in the coking process, which in turn are dependent on the composition of the crude oil and refinery processing from which the feedstock is derived.

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for calcined petroleum coke.

NICNAS has assessed calcined petroleum coke in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to human health[1] .

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No

[1] https://www.industrialchemicals.gov.au/chemical-information/search-assessments?assessmentcasnumber=64743-05-1

Convention, Protocol or Other International Control	Listed Yes or No?
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

Elemental carbon and the residual components are not water-soluble and are not volatile in the environment. The substance is chemically and physically inert. Therefore, biodegradation, atmospheric photooxidation, and hydrolysis will be negligible (USEPA, 2011). Volatilization is negligible. Depending on factors such as particle size and density relationships between the petroleum coke and environmental media, releases to terrestrial or aquatic environments would result in incorporation of the material in soils/sediments or dispersal via wind/water action (API, 2008). While it may be persistent (because not biodegradable), it is not a concern because it has a low environmental or health hazard potential (API, 2000).

Calcined petroleum coke is not expected to biodegrade since it is composed mainly of elemental carbon which does not contain the chemical bonds that microbes require for metabolism. Other potential constituents embedded in the carbon matrix include inorganic substances and high molecular weight hydrocarbon compounds that may remain as residuum from the coking process. These constituents would not be expected to be available for microbial degradation (API, 2008; USEPA, 2011).

Being water-insoluble and physically and biologically inert, calcined petroleum coke is not expected to bioaccumulate.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Calcined petroleum coke is of low toxicity concern to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Green petroleum coke was tested for potential aquatic toxicity using aqueous exposure solutions prepared as water accommodated fractions (WAFs). An attempt was made to analytically quantify specific organic and inorganic constituents of petroleum coke in the WAF solutions. None of those constituents of petroleum coke were present in the WAF solutions at their analytical detection limits. Because a solubility level could not be established by analytical means, aquatic toxicity test endpoints are presented as nominal WAF loading rates.

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on green petroleum coke.

Table 3 Acute Aquatic Toxicity Studies on Green Petroleum Coke

Test Species	Endpoint	Results (mg/L)*	Klimisch Score	Reference
Pimephales promelas	96-hour LL_{50} 96-hour NOELR	>1,000 1,000	1	API, 2008; USEPA, 2011
Daphnia magna	48-hour EL_{50} 48-hour NOELR	>1,000 1,000	1	API, 2008; USEPA, 2011
Selenastrum capricornutum	96-hour EL_{50} 96-hour NOELR	>1,000 1,000	1	API, 2008; USEPA, 2011

*WAF nominal loading rate.

Chronic Studies

No studies are available.

C. Terrestrial Toxicity

Green petroleum coke was tested for potential terrestrial toxicity using aqueous exposure solutions prepared as WAFs (see above text for aquatic toxicity).

The results of acute terrestrial toxicity studies conducted on green petroleum coke are presented in Table 4.

Table 4 Terrestrial Toxicity Tests on Green Petroleum Coke

Test Species	Endpoint	Results (mg/kg soil dw)	Klimisch Score	Reference
Earthworm (*Eisenia fetida*)	14-day LC_{50} 14-day NOEC	>1,000 1,000	1	API, 2008; USEPA, 2011
Terrestrial plant (corn)	21-day LC_{50} 21-day NOEC	>1,000 1,000	1	API, 2008; USEPA, 2011
Terrestrial plant (radish)	21-day LC_{50} 21-day NOEC	>1,000 1,000	1	API, 2008; USEPA, 2011
Terrestrial plant (soybean)	21-day LC_{50} 21-day NOEC	>1,000 1,000	1	API, 2008; USEPA, 2011

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Calcined petroleum coke is not biodegradable and thus meets the screening criteria for persistence.

Calcined petroleum coke is not expected to bioaccumulate. Coke is composed of elemental carbon and volatile matter, which are water-insoluble and not bioavailable. Thus, calcined petroleum coke does not meet the screening criteria for bioaccumulation.

No chronic aquatic toxicity studies are available for calcined petroleum coke. However, acute toxicity studies on green petroleum coke showed EC_{50} values of >1,000 mg/L the nominal WAF loading rate. Thus, calcined petroleum coke does not meet the screening criteria for toxicity.

The overall conclusion is that calcined petroleum coke is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for calcined petroleum coke.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Calcined Petroleum Coke	64743-05-1	Not a PBT	No	No	Yes	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
API	American Petroleum Institute
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
dw	dry weight
EC	effective concentration
ECHA	European Chemicals Agency
EL	effect level
EU	European Union
HPVIS	High Production Volume Information System
IChEMS	Industrial Chemicals Environmental Management Standard
IMAP	Inventory Multi-tiered Assessment and Prioritisation
IUPAC	International Union of Pure and Applied Chemistry

kg/m^3	kilogram per cubic metre
kPa	kilopascal
LC	lethal concentration
LL	lethal loading
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
NOEC	no observed effect concentration
NOELR	No Observed Effect Loading Rate
PBT	Persistent Bioaccumulative Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency
UVCB	Unknown or Variable Composition, Complex Reaction Products and Biological Materials
WAF	water accommodated fraction

CALCIUM ALUMINATE
CALCIUM ALUMINATE CEMENT

This dossier on calcium aluminate and calcium aluminate cement presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Calcium aluminate and calcium aluminate cement are classified as **tier 1** chemicals and requires a hazard assessment only.

1 BACKGROUND

Calcium aluminate cement is distinguished by its chemical composition predominantly featuring calcium aluminate phases. Calcium aluminate cement is made by sintering limestone and bauxite. This type of cement is known for its rapid hardening properties and resistance to chemical attack, particularly in environments with high sulfate and acidic conditions[1].

Upon mixing with water, calcium aluminate cement undergoes rapid dissolution of calcium (Ca^{2+}) and aluminium (Al_3^+) ions, followed by nucleation and growth of metastable hexagonal hydrates $CaAl_2O_4 \bullet 10H_2O$ (CAH_{10}) and $Ca_2Al_2O_5 \bullet 8H_2O$ (C_2AH_8). These ions are ubiquitous in the environment and will not accumulate in living tissues. The substances are of low toxicity concern to aquatic and terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): calcium oxido(oxo)alumane

CAS RN: 12042-68-1

Molecular formula: Al_2CaO_4

Molecular weight: 158.04 g/mol

Synonyms: calcium aluminate, Aluminium calcium oxide, Dialuminium calcium tetraoxide

Chemical Name (IUPAC): cement, alumina, chemicals

CAS RN: 65997-16-2

[1] (2025). Calcium Aluminate Cement. In: Dictionary of Concrete Technology. Springer, Singapore. https://doi.org/10.1007/978-981-97-2998-2_152

Molecular formula: Unspecified. UVCB (substance of unknown or variable composition, complex reaction product or biological material)

Molecular weight: Unspecified

Synonyms: calcium aluminate cement; high-alumina cement; cement bonded alumina

3 PHYSICO-CHEMICAL PROPERTIES

Limited data is available for calcium aluminate. Key physical and chemical properties for calcium aluminate cement are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Calcium Aluminate Cement

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Solid	2	ECHA
Melting Point	1535°C @ 101.3 kPa	2	ECHA
Boiling Point	Decomposes below 300 °C	-	ECHA
Density	2238 kg/m^3 @ 20°C	2	ECHA
Vapor Pressure	0 Pa @ 20 °C	-	ECHA
Partition Coefficient (log K_{ow})	Not applicable, substance is organic	-	ECHA
Dissociation Constant (pKa)	Not relevant	-	ECHA
Water Solubility	0.64 g/L @ 20°C	2	ECHA
Viscosity	Not applicable, substance is a solid	-	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for calcium aluminate and calcium aluminate cement.

NICNAS has assessed calcium aluminate cement in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to human health and the environment.[2] [3]

[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=907c433e-f36b-1410-8c14-0026b2c59b62
[3] https://services.industrialchemicals.gov.au/assessment-detail/?id=bfd3433e-f36b-1410-8e4e-00f1fcf8411a

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

Upon mixing with water, calcium aluminate cement undergoes rapid dissolution of calcium (Ca^{2+}) and aluminium (Al_3^+) ions, followed by nucleation and growth of metastable hexagonal hydrates $CaAl_2O_4 \bullet 10H_2O$ (CAH_{10}) and $Ca_2Al_2O_5 \bullet 8H_2O$ (C_2AH_8). Aluminium is the third most abundant element in the earth's crust, making up approximately 8% of rocks and minerals and accounting for about 1% of the total mass of the Earth. Aluminium is a naturally occurring element and is present in all water bodies. Calcium is the fifth most abundant element in the earth´s crust. Calcium is a naturally occurring element and is present in all water bodies. Neither calcium aluminate, calcium aluminate cement nor their dissociated ions are expected to bioaccumulate (ECHA).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Calcium aluminate and calcium aluminate cement have low toxicity concern to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

No data are available for calcium aluminate. Table 3 lists the results of acute aquatic toxicity studies conducted on calcium aluminate cement. The toxicity can be described to the pH increase due to the addition of OH^-, as the calcium and aluminium concentrations are too low to explain the effects. In actual aquatic environments, the LC_{50} should be greater than 10 mg/L (ECHA).

Table 3: Acute Aquatic Toxicity Studies on Calcium Aluminate Cement

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Danio rerio (Zebrafish)	96-hr LC_{50}	>100	2	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	5.4	2	ECHA

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Desmodesmus subspicatus (Green algae)	72-hr EC_{50}	3.6 (growth)	1	ECHA

Chronic Studies

Chronic studies are not available for fish and invertebrates.

The 72-hr NOEC value for calcium aluminate cement in *Desmodesmus subspicatus* (Green algae) was 2.6 mg/L (ECHA). [Kl. Score = 1]

C. Terrestrial Toxicity

No studies are available. Direct and indirect exposure of the soil compartment is unlikely (ECHA).

7 CATEGORISATION AND OTHER CHARACTERISTIC OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Calcium aluminate and calcium aluminate cement are inorganic substances. Biodegradation is not applicable. For the purposes of this PBT assessment, the persistent criteria are not considered applicable.

Calcium aluminate and calcium aluminate cement are not expected to bioaccumulate due to their low potential for bioavailability and moderate water solubility. Thus, they do not meet the screening criteria for bioaccumulation.

The NOEC from chronic aquatic toxicity studies conducted on algae are >0.1 mg/L. The acute EC_{50} values are >1 mg/L in fish, invertebrates and algae. Thus, calcium aluminate and calcium aluminate cement do not meet the screening criteria for toxicity.

The overall conclusion is that calcium aluminate and calcium aluminate cement are not PBT substances.

B. Other Characteristics of Concern

No other characteristics of concern were identified for calcium aluminate and calcium aluminate cement.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Calcium aluminate	12042-68-1	Not a PBT	No	No	NA	No	No	No	No data	No data	1
Calcium aluminate cement	65997-16-2	Not a PBT	No	No	NA	No	No	No	1 (fish); 2 (inv & algae)	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework). In actual aquatic environments, the LC50 should be greater than 10 mg/L. Thus, a designation of Tier 1 was assigned based on consideration of chronic results.

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

European Chemicals Agency [ECHA]. ECHA REACH database: https://echa.europa.eu/information-on-chemicals/registered-substances

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Klimisch, H.J., Andreae, M., and Tillmann, U. (1997). A systematic approach for evaluating the quality of experimental and toxicological and ecotoxicological data. *Regul. Toxicol. Pharmacol. 25*:1–5.

B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
ANZECC	Australian and New Zealand Environment and Conservation Council
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kPa	kilopascal
LC	lethal concentration
mg/L	milligrams per litre
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
NOEC	no observed effective concentration
OECD	Organisation for Economic Co-operation and Development
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
SIDS	Screening Information Data Set

CALCIUM CARBONATE

This dossier on calcium carbonate presents the most critical studies pertinent to the risk assessment of calcium carbonate in its use in coal seam gas extraction activities. It does not represent an exhaustive or critical review of all available data. The information presented in this dossier was obtained primarily from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Calcium carbonate is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

Calcium carbonate is an inorganic compound, the most natural forms being chalk, limestone and marble. It is partially soluble in water, dissociating into calcium (Ca^{2+}) and carbonate (CO_3^{2-}) ions; both are ubiquitous in the environment. The ions will not adsorb on particulate matter or surfaces and will not accumulate in living tissues. Calcium carbonate is of low toxicity concern to aquatic and terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): calcium carbonate

CAS RN: 471-34-1

Molecular formula: $CaCO_3$ or $CCaO_3$ or $CH_2O_3.Ca$

Molecular weight: 100.09 g/mol

Synonyms: Calcium carbonate, precipitated; carbonic acid, calcium salt (1:1); aragonite; calcium monocarbonate; monocalcium carbonate

Chemical Name (IUPAC): calcium carbonate

CAS RN: 1317-65-3

Molecular formula: Not applicable, UVCB

Molecular weight: Not applicable, UVCB

Synonyms: Limestone; ground calcium carbonate; chalk; natural calcium carbonate

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Calcium Carbonate (CAS RN 471-34-1)

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	White powder	1	ECHA
Melting Point	>825°C (decomposes) @ 101.3 kPa	2	ECHA
Boiling Point	Decomposes	-	ECHA
Density	2700 to 2950 kg/m^3 @ 20 °C	2	ECHA
Vapor Pressure	Not applicable, melting point > 300 °C	-	ECHA
Partition Coefficient (log K_{ow})	Not applicable, substance is inorganic	-	ECHA
Dissociation Constant (pKa)	Not feasible due to solubility	-	ECHA
Water Solubility	0.0166 g/L @ 20°C (slightly soluble)	1	ECHA
Viscosity	Not applicable, substance is a solid	-	-

Precipitated calcium carbonate (CAS RN 471-34-1) is produced industrially through the decomposition of limestone to calcium oxide followed by subsequent decarbonisation. Ground calcium carbonate (CAS RN 1317-65-3) results directly from the mining of limestone. This extraction process helps to maintain carbonate close to its original state of purity. Both natural and ground calcium carbonate can contain low levels of impurities, but precipitated calcium carbonate is purer than ground calcium carbonate (NCBI, 2024).

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for calcium carbonate.

NICNAS has assessed calcium carbonate in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to human health and the environment[1][2]. In addition, based on an assessment of human health and environmental hazards, NICNAS identified ground calcium carbonate [also referred to as limestone (CAS RN 1317-65-3)] as a chemical of low concern to the environment (NICNAS, 2017 and DoEE, 2017). Chemicals of low concern are unlikely to have adverse environmental effects or be a concern to human health if they are released to the environment from coal seam gas operations.

[1] https://www.industrialchemicals.gov.au/chemical-information/search-assessments?assessmentcasnumber=471-34-1%2C+

[2] https://www.industrialchemicals.gov.au/chemical-information/search-assessments?assessmentcasnumber=1317-65-3

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

"Calcium carbonate, or $CaCO_3$, comprises more than 4% of the earth's crust and is found throughout the world. Its most natural forms are chalk, limestone, and marble, produced by the sedimentation of the shells of small fossilised snails, shellfish, and coral over millions of years."[3]

Calcium carbonate is partially soluble in water, dissociating into calcium (Ca^{2+}) and carbonate (CO_3^{2-}) ions. Both ions are ubiquitous in the environment.

The addition of calcium carbonate to an aquatic ecosystem could result in a shift towards alkalinity and a tendency to increase the pH. The carbonate ions will react with water, forming bicarbonate (HCO_3^-) and hydroxide (OH^-) ions, until an equilibrium is reached. A re-equilibration takes place when carbonate (CO_3^{2-}) is dissolved in water according to the following equations:

$HCO_3^- \leftrightarrow CO_3^{2-} + H^+$ $pK_a = 10.33$

$CO_2 + H_2O \leftrightarrow HCO_3^- + H^+$ $pK_a = 6.35$

Only a small fraction of the dissolved CO_2 is present as H_2CO_3 (carbonic acid); the major part is present as CO_2. The amount of CO_2 in water is in equilibrium with the partial pressure of CO_2 in the atmosphere. The CO_2/ HCO_3^-/ CO_3^{2-} equilibria are the major buffers of the pH of freshwater.

Based on these equations, CO_2 is the predominant species at a pH smaller than 6.35, while HCO_3^- is the predominant species at a pH in the range of 6.35-10.33 and CO_3^{2-} is the predominant species at a pH higher than 10.33.

Ca^{2+} and CO_3^{2-} ions are not expected to adsorb on particulate matter or surfaces and will not accumulate in living tissues.

[3] (http://www.ima-na.org/page/what_is_calcium_carb).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Calcium carbonate is of low toxicity concern to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on calcium carbonate.

Table 3 Acute Aquatic Toxicity Studies on Calcium Carbonate (Nano)*

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Oncorhynchus mykiss	96-hour LC_{50}	>100% (saturated solution)	1	ECHA
Daphnia magna	48-hour EC_{50}	>100% (saturated solution)	1	ECHA
Desmodescus subspicatus	72-hour EC_{50} 72-hour EC_{10}	>14 mg/L** >14 mg/L**	1	ECHA

*The nano form was tested because this form was anticipated to represent the worst case as it was likely to be more soluble than the bulk form due to the smaller particle size and hence greater surface area.
**Highest attainable test concentration that could be prepared due to the limited solubility of the test material.

Chronic Studies

No studies are available.

C. Terrestrial Toxicity

Table 4 lists the results of terrestrial toxicity studies conducted on calcium carbonate.

Table 4 Terrestrial Toxicity Studies on Calcium Carbonate (Nano)*

Test Species	Endpoint	Results (mg/kg soil dw)	Klimisch score	Reference
Eisenia foetida	14-day LC_{50} NOEC	>1,000 1000	1	ECHA
Nitrogen transformation	28-day EC_{50} NOEC	>1,000 1,000	1	ECHA

*The nano form was tested because this form was anticipated to represent the worst case as it was likely to be more soluble than the bulk form due to the smaller particle size and hence greater surface area.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Calcium carbonate is an inorganic salt that dissociates completely to calcium and carbonate ions in aqueous solutions. Biodegradation is not applicable to these inorganic ions; both calcium and carbonate ions are also ubiquitous and are present in most water, soil and sediment. For the purposes of this PBT assessment, the persistent criteria are not considered applicable to this inorganic salt.

Calcium and carbonate ions are essential to all living organisms and their intracellular and extracellular concentrations are actively regulated. Thus, calcium carbonate is not expected to bioaccumulate.

No chronic aquatic toxicity data exist on calcium carbonate; however, the acute EC_{50} values are >1 mg/L in fish, invertebrates and algae. Thus, calcium carbonate does not meet the screening criteria for toxicity.

The overall conclusion is that calcium carbonate is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for calcium carbonate.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Calcium carbonate, precipitated	471-34-1	Not a PBT	No	No	NA	No	No	No	1	1	1
Calcium carbonate, ground	1317-65-3	Not a PBT	No	No	NA	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

Department of the Environment and Energy [DoEE]. (2017). *Environmental risks associated with surface handling of chemicals used in coal seam gas extraction in Australia*. Prepared by the Chemicals and Biotechnology Assessments Section (CBAS), in the Chemicals and Waste Branch of the Department of the Environment and Energy as part of the National Assessment of Chemicals Associated with Coal Seam Gas Extraction in Australia, Commonwealth of Australia, Canberra. Available: https://www.dcceew.gov.au/sites/default/files/documents/technical-report-number-14-environmental-risks.pdf

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy

dw	dry weight
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
IChEMS	Industrial Chemicals Environmental Management Standard
IMAP	Inventory Multitiered Assessment and Prioritisation Program
IUPAC	International Union of Pure and Applied Chemistry
kg/m^3	kilogram per cubic metre
kPa	kilopascal
LC	lethal concentration
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NOEC	no observed effective concentration
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
UVCB	unknown or variable composition, complex reaction products and biological materials

CALCIUM LIGNOSULFONATE

This dossier on calcium lignosulfonate presents the most critical studies pertinent to coal seam gas extraction activities. It does not represent an exhaustive or critical review of all available data. Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Calcium lignosulfonate is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

Lignin is the second largest component of wood. It is a highly polymerised material that makes up the middle lamella of woody fibres and holds the fibres together. The basic units of the polymeric structure consist of three aromatic propenyl alcohols (monolignols): coniferyl alcohol (4-(3-hydroxy-1-propenyl)-2-methoxyphenol); p-coumaryl alcohol (4-[(E)-3-hydroxyprop-1-enyl]phenol); and sinapyl alcohol (4-hydroxy-3,5-dimethoxycinnamyl alcohol). Coniferyl alcohol represents the principle unit in lignin.

Calcium lignosulfonate is obtained from the spent sulfite and sulfate pulping liquor of wood or from the sulfate (kraft) pulping process. It may contain up to 30% reducing sugars.

This dossier contains toxicity data on calcium lignosulfonate (40-65). Calcium lignosulfonate (40-65) is produced from softwood in the sulfite pulping method for manufacturing paper. In this process, bisulfite ions react with the native lignin polymer of the wood to form sulfonated lignin (lignosulfonate). This reaction increases the water solubility of the hydrophobic lignin polymer. Calcium lignosulfonate contains <5% reducing sugars. The calcium bisulfite provides the calcium ions that stabilise the anionic sulfonate groups in the lignosulfonates. The average molecular weight is in the range of 40,000 to 65,000 daltons, with >90% ranging from 1,000 to 250,000 (EFSA, 2010). Calcium lignosulfonate (40-65) is of higher purity than calcium lignosulfonate, with a higher degree of polymerisation and lower content of sugars.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Calcium lignosulfonate

CAS RN: 8061-52-7

Molecular formula: Not applicable

Molecular weight: Unknown

Synonyms: Calcium lignosulfonate; lignosulfonic acid, calcium salt; lignin calcium sulfonate

3 PHYSICO-CHEMICAL PROPERTIES

Calcium lignosulfonate and calcium lignosulfonate (40-65) occur as a brown, amorphous polymer (EFSA, 2010). They are soluble in water, but not in any of the common organic solvents.

The pH of a 1:100 aqueous solution of calcium lignosulfonate is between ca. 3 and 11 (EFSA, 2010).

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 1). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for calcium lignosulfonate.

NICNAS has assessed calcium lignosulfonate in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to human health.[1]

Table 1 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

No specific data could be located on the environmental fate/transport of calcium lignosulfonate. The United States Environmental Protection Agency (USEPA) reviewed the environmental fate and environmental hazards of various lignosulfonate chemicals, including sodium lignosulfonate, for a proposed rule to establish 44 tolerance exemptions for residues of these substances (FR, 2005). The USEPA determined "that the various salts of lignosulfonic acid are soluble to very highly water soluble depending on the cation. Once in water, dissociation of the cation is expected depending on pH. These lignosulfonates are not expected to be mobile in terrestrial environments, moving equally with the water and sediment phase to surface water. Ground water migration is not likely. Once in water, the dissociated cation and anion are likely to remain in dissolution. The available information suggest that lignosulfonates may be persistent in aquatic environment of low microbial activity and much less persistent in environments with ample microbial activity. However, the time for complete aerobic degradation is predicted to be months. The lignosulfonates are strongly absorbed to soils and sediments due to their high-molecular weights. Based on the USEPA assessment, it is concluded that sodium lignosulfonate would meet the EU screening criteria for persistence.

Due to its high-molecular weight, sodium lignosulfonate is not expected to be bioavailable. This is supported by pharmacokinetic data on calcium lignosulfonate, which showed that it is poorly absorbed from the gastrointestinal tract of rats (Beck and Rossi, 2005). Thus, it is not expected to bioaccumulate.

[1] https://www.industrialchemicals.gov.au/chemical-information/search-assessments?assessmentcasnumber=8061-52-7%2C+

6 ENVIRONMENTAL EFFECTS SUMMARY

Because of the lack of data, the EFSA Panel on Additives and Products or Substances used in Animal Feed (FEEDAP) could not conclude on the safety of calcium lignosulfonate for the environment (EFSA, 2015).

A. Aquatic Toxicity

No data are available.

B. Terrestrial Toxicity

No data are available.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Based on the assessment by the USEPA (FR, 2005), calcium lignosulfonate meets the criteria for persistence.

Calcium lignosulfonate is not expected to bioaccumulate due to its low potential for bioavailability because of its molecular weight and size. Thus, it does not meet the criteria for bioaccumulation.

No aquatic toxicity studies are available for calcium lignosulfonate. It is expected to be a low concern of toxicity to aquatic organisms because of its low potential for bioavailability.

The overall conclusion is calcium lignosulfonate is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for calcium lignosulfonate.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Calcium lignosulfonate	8061-52-7	Not a PBT	No	No	Yes	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

Beck, M., and Rossi, B. (2005). *Absorption, distribution and excretion of tritium labeled lignosulfonate after single oral administration to rats*. Report No. 2500147, DSM Nutritional Products Ltd.; cited in EFSA (2010).

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B. Abbreviations and Acronyms

AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
ECHA	European Chemicals Agency
EFSA	European Food Safety Authority
EU	European Union
IChEMS	Industrial Chemicals Management Standard
IMAP	Inventory Multi-tiered Assessment and Prioritisation
IUPAC	International Union of Pure and Applied Chemistry
KI	Klimisch scoring system
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals

SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

CALCIUM OXIDE
CALCIUM HYDROXIDE

This dossier on calcium oxide and calcium hydroxide presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam gas extraction activities. It does not represent an exhaustive or critical review of all available data. The information presented in this dossier was obtained primarily from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Calcium oxide and calcium hydroxide are classified as a **tier 1** chemicals and requires a hazard assessment only.

1 BACKGROUND

Calcium oxide and calcium hydroxide are inorganic compounds. They are partially soluble in water, dissociating into calcium (Ca^{2+}) and hydroxyl (OH^-) ions; both are ubiquitous in the environment. The ions will not adsorb on particulate matter or surfaces and will not accumulate in living tissues. The substances are of low toxicity concern to aquatic and terrestrial organisms.

For the purposes of this dossier, information will be focused on calcium hydroxide as both the oxides and hydroxides of calcium have the same environmental fate and toxicity profiles.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Calcium oxide

CAS RN: 1305-78-8

Molecular formula: CaO

Molecular weight: 56.08 g/mol

Synonyms: Lime; Quicklime; Burnt lime; Calcia; Calxyl; Gebrannter kalk; Unslaked lime; Calcium monoxide

Chemical Name (IUPAC): Calcium dihydroxide

CAS RN: 1305-62-0

Molecular formula: CaH_2O_2

Molecular weight: 74.09 g/mol

Synonyms: calcium hydroxide; slaked lime; hydrated lime; calcium hydroxide, hydrated

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Calcium Hydroxide

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Off-white powder	1	ECHA
Melting Point	> 450°C @101.3 kPa	1	ECHA
Boiling Point	2,850°C @ 101.3 kPa	2	ECHA
Density	3310 kg/m^3 @ 22.0 ±1.0°C	1	ECHA
Vapor Pressure	Not applicable, melting point is > 300 °C	-	ECHA
Partition Coefficient (log K_{ow})	Not applicable	-	ECHA
Dissociation Constant (pKa)	12.6 @ 20°C	2	ECHA
Water Solubility	1.34 g/L @ 20 ± 0.5°C	1	ECHA
Viscosity	Not applicable, substance is a solid	-	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for calcium hydroxide.

NICNAS has assessed calcium oxide in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to the environment. [1]

NICNAS has also assessed calcium hydroxide in an IMAP Tier 1 assessment and concluded that it is an inorganic substance comprising ions of low ecotoxicological concern. This chemical is not expected to pose an unreasonable risk to the environment provided that ANZECC water quality guidelines for physical and chemical stressors are not exceeded.[2]

Based on an assessment of environmental hazards, NICNAS identified calcium oxide as a chemical of low concern to the environment (DoEE, 2017). Chemicals of low concern are unlikely to have adverse environmental effects if they are released to the environment from coal seam gas operations.

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=e88b433e-f36b-1410-8c14-0026b2c59b62
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=bc5d433e-f36b-1410-8924-008e64e216c7

Convention, Protocol or Other International Control	Listed Yes or No?
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

As an inorganic substance, calcium hydroxide is expected to disassociate in the environment to its respective cation and anion as limited by its aqueous solubility and pH.

In soil as well as in sediment-water systems, calcium hydroxide will react and release calcium ions and hydroxyl ions. Therefore, relevant information on adsorption/desorption of calcium hydroxide can be broadened to data on adsorption/desorption of calcium and magnesium. The behaviour of hydroxyl ions depends on the pH buffer capacity of the tested medium. The pH buffer capacity is controlled by a whole range of processes (mineral dissolution/precipitation, protonation/deprotonation of pH dependent charge sites, reaction with CO_2, biological processes, etc.) and as such, partition coefficients are not relevant for the fate and behaviour of OH- in soils or sediment.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Calcium hydroxide is of low toxicity concern to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on calcium hydroxide.

Table 3 Acute Aquatic Toxicity Studies on Calcium Hydroxide

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Oncorhynchus mykiss	96-hour LC_{50}	50.6 mg/L	1	ECHA
Daphnia magna	48-hour EC_{50}	49.1 mg/L	1	ECHA
Pseudokirchneriella subcapitata	72 hour EC_{50}	184.57 mg/L	1	ECHA

Chronic Studies

A 42-day *Oncorhynchus mykiss* test showed that enhanced Ca^{2+} diets (60 mg Ca^{2+}) had no effects on survival. Mean fish weights remained constant across all treatments (ECHA) [KI Score = 4]. A 14-day

NOEC of 32 mg/L was determined for the invertebrate *Crangon septemspinosa* (ECHA) [Kl Score = 2]. A 72-hr NOEC of 48 mg/L was determined for *Pseudokirchneriella subcapitata* based on growth rate (ECHA [Kl Score = 2].

C. Terrestrial Toxicity

Calcium and hydroxyl ions are ubiquitous in the environment and are found naturally in soil, water and sediment. Calcium is an important constituent of most soils and the minerals found in soil are mostly compounds of calcium with other substances. Ecotoxicological tests with plants and soil invertebrates have recorded low chronic toxicity values (NOECs/ECs) in the range of 1,080 to 5,000 mg/kg soil dw.

In a study conducted according to OECD Guideline 207, short-term toxicity of calcium dihydroxide on the mortality and biomass of the earthworm *Eisenia foetida* was assessed. After 14 days, no significant effect on both mortality and biomass was observed up to the highest tested dose (5000 mg Ca(OH)2 /kg dw) (ECHA) [Kl. Score =1].

In a chronic study conducted according to OECD Guideline 222, the effect of calcium dihydroxide on the reproduction of the earthworm *Eisenia foetida* was evaluated. The study resulted in a 4w-EC_{50} of 4180 mg $Ca(OH)_2$ /kg soil dw and a 4w-NOEC of 2000 mg $Ca(OH)_2$ /kg soil dw. (ECHA) [Kl. Score =1].

In a 21-day OECD Guideline 208 (Terrestrial Plants Test: Seedling Emergence and Seedling Growth Test), the effects on seedling emergence and growth of calcium dihydroxide to six species of plants (sugar beet, oilseed rape, spinach, pea, wheat and leek) were assessed. The results of the test indicate that of the six species tested, oilseed rape, sugar beet, spinach and leek were most sensitive to the effects of calcium dihydroxide. Survival after seedling emergence (LC_{50}) was only affected in leeks. Upon addition of the test item to the soil, a dose-dependent increase in soil pH was observed. In the course of the study, the pH value decreased. The increase in pH value of the soil after addition of calcium dihydroxide is considered to determine the toxicity to plants. NOEC values varied between 1080 and 2270 mg $Ca(OH)_2$ /kg soil dw. (ECHA) [Kl. Score =1].

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Calcium hydroxide is an inorganic salt that dissociates to calcium and hydroxyl ions in aqueous solutions. Biodegradation is not applicable to these inorganic ions; both calcium and hydroxyl ions are also ubiquitous and are present in most water, soil and sediment. For the purposes of this PBT assessment, the persistent criteria are not considered applicable to this inorganic salt.

Calcium and hydroxyl ions are essential to all living organisms, and their intracellular, and extracellular concentrations are actively regulated. Thus, calcium hydroxide is not expected to bioaccumulate.

NOEC values from chronic aquatic toxicity studies are > 0.1 mg/L for calcium hydroxide. The acute $E(L)C_{50}$ values for calcium hydroxide are >1 mg/L in invertebrates and algae. Thus, calcium hydroxide does not meet the screening criteria for toxicity.

The overall conclusion is that calcium hydroxide and calcium oxide are not PBT substances.

B. Other Characteristics of Concern

No other characteristics of concern were identified for calcium hydroxide or calcium oxide.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Calcium oxide	1305-78-8	Not a PBT	No	No	NA	No	No	No	1	1	1
Calcium hydroxide	1305-62-0	Not a PBT	No	No	NA	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

Department of the Environment and Energy [DoEE]. (2017). *Environmental risks associated with surface handling of chemicals used in coal seam gas extraction in Australia*. Prepared by the Chemicals and Biotechnology Assessments Section (CBAS), in the Chemicals and Waste Branch of the Department of the Environment and Energy as part of the National Assessment of Chemicals Associated with Coal Seam Gas Extraction in Australia, Commonwealth of Australia, Canberra. Available: https://www.dcceew.gov.au/sites/default/files/documents/technical-report-number-14-environmental-risks.pdf

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Industrial Chemicals Environmental Management Standard [IChEMS]. (2022). Australian Environmental Criteria for Persistent, Bioaccumulative and/or Toxic Chemicals. https://www.dcceew.gov.au/sites/default/files/documents/australian-pbt-criteria.pdf

Klimisch, H.J., Andreae, M., and Tillmann, U. (1997). A systematic approach for evaluating the quality of experimental and toxicological and ecotoxicological data. *Regul. Toxicol, Pharmacol. 25*:1–5.

B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy
dw	dry weight
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg/m^3	kilogram per cubic metre
kPa	kilopascal
LC	lethal concentration

mg/kg	milligrams per kilogram
mg/L	milligrams per litre
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
NOEC	no observed effective concentration
PBT	Persistent, Bioaccumulative and Toxic
PEC	Predicted exposure concentrations
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases

CALCIUM SULPHATE DIHYDRATE [CAS RN 10101-41-4]
GYPSUM [CAS RN 13397-24-5]
CALCIUM SULPHATE [CAS RN 7778-18-9]
CALCIUM SULPHATE HEMIHYDRATE [CAS RN 10034-76-1]

This dossier on calcium sulphate and related substances presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. Limited information is available for gypsum and calcium sulphate hemihydrate, however, they are expected to have similar environmental concerns as calcium sulphate and calcium sulphate dihydrate.

This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the OECD-SIDS documents on calcium sulphate dihydrate (OECD, 2003). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – calcium sulphate dihydrate, calcium sulphate, gypsum and calcium sulphate hemihydrate are classified as **tier 1** chemicals and require a hazard assessment only.

1 BACKGROUND

Calcium sulphate, dihydrate is a colourless solid inorganic substance with monoclinic and hygroscopic properties. It is moderately soluble in water, dissociating into calcium (Ca^{2+}) and sulphate (SO_4^{2-}) ions; both are ubiquitous in the environment. These ions are also essential to all living organisms (flora and fauna) and their intracellular and extra-cellular concentrations are actively regulated. Biodegradation is not applicable to inorganic compounds and neither calcium sulphate, dihydrate nor its dissociated ions are expected to bioaccumulate. Calcium sulphate dihydrate is of low toxicity concern to aquatic organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): calcium sulfate, dihydrate

CAS RN: 10101-41-4

Molecular formula: CaH_4O_6S

Molecular weight: 172.17 g/mol

Synonyms: Calcium sulphate dihydrate; calcium sulfate—water (1/1/2); sulfuric acid, calcium salt, dihydrate; phosphogypsum; Landplaster; GIPS; Alabaster Annaline; C.I. Pigment white 25; gypsum; gypsum stone land and plaster; light spar; magnesia white; mineral white; native calcium sulfate; precipitated calcium sulfate ; Sainite; Satin spar; sulfuric acid, calcium(2+) salt, dihydrate ;terra alba

Chemical Name (IUPAC): calcium sulfate

CAS RN: 7778-18-9

Molecular formula: CaO_4S

Molecular weight: 136.14 g/mol

Synonyms: anhydrous gypsum; basic calcium sulfate; calcium sulfate, anhydrous; Drierite; Karstenite; Muriacite; Crysalba; Osteoset; Thiolite; anhydrous sulfate of lime; natural anhydrite; sulfuric acid, calcium salt (1:1)

Chemical Name (IUPAC): dicalcium;disulfate;hydrate

CAS RN: 10034-76-1

Molecular formula: $(CaSO_4)_2.H_2O$

Molecular weight: 290.3 g/mol

Synonyms: calcium sulphate hemihydrate; calcium sulfate hemihydrate; plaster of paris

Chemical Name (IUPAC): calcium sulfate dihydrate (Gypsum)

CAS RN: 13397-24-5

Molecular formula: $Ca.H_2O_4S.2H_2O$

Molecular weight: 174.19 g/mol

Synonyms: gypsum; gypsum (Ca(SO4).2H2O); gypsite

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Calcium Sulphate Dihydrate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	White, odorless crystalline solid	-	NCBI, 2025
Melting Point	100–150°C pressure not provided	-	NCBI, 2025
Boiling Point	No data available	-	OECD, 2003
Density	2320 kg/m^3, temperature not indicated	-	NCBI, 2025
Vapor Pressure	Not applicable for the salt of inorganic compounds	-	OECD, 2003

Property	Value	Klimisch Score	Reference
Partition Coefficient (log K_{ow})	Not applicable for the salt of inorganic compounds	-	OECD, 2003
Dissociation constant (pKa)	Not available	-	-
Water Solubility	2.05 g/L @ 20°C	-	OECD, 2003
Viscosity	Not applicable, substance is a solid	-	-

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for these substances.

NICNAS has assessed calcium sulphate dihydrate and calcium sulphate in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to human health or the environment.[1][2] Calcium sulphate dihydrate is an inorganic substance comprising ions of low ecotoxicological concern. This chemical is not expected to pose an unreasonable risk to the environment provided that ANZECC[3] water quality guidelines for physical and chemical stressors are not exceeded.

NICNAS has also assessed calcium sulfate hemihydrate sulphate in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to human health[4]. In an AICIS evaluation statement, calcium sulfate hemihydrate was determined to be a chemical that is unlikely to require further regulation to manage risks to the environment.[5]

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

[1] https://www.industrialchemicals.gov.au/chemical-information/search-assessments?assessmentcasnumber=10101-41-4
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=2e65433e-f36b-1410-8de4-00e8f2afc108
[3] Water quality guidelines were revised in 2018 and are now referred to as Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG)
[4] https://services.industrialchemicals.gov.au/assessment-detail/?id=d052433e-f36b-1410-8924-008e64e216c7
[5] https://services.industrialchemicals.gov.au/assessment-detail/?id=c489433e-f36b-1410-840a-00e4f8b2bd83

5 ENVIRONMENTAL FATE SUMMARY

Calcium sulphate, dihydrate is a colourless solid inorganic substance with monoclinic and hygroscopic properties (OECD, 2003). In aqueous solutions, the substance is moderately soluble, dissociating into calcium (Ca^{2+}) and sulphate (SO_4^{2-}) ions that are ubiquitous in the environment. Calcium will be assimilated by species present in the water and is necessary to maintain a good chemical balance in soils, water and plants and sulphate will either become part of the sulphur cycle or be assimilated by microorganisms and plants (ECHA). Biodegradation is not applicable to inorganic compounds. These ions are also essential to all living organisms (flora and fauna) and their intracellular and extra-cellular concentrations are actively regulated. As a result, neither calcium sulphate, dihydrate nor its dissociated ions are expected to bioaccumulate (OECD, 2003).

As a component in gypsum (95% calcium sulphate, dihydrate), it is inert in normal environmental conditions.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Calcium sulphate dihydrate is of low acute toxicity to aquatic organisms.

B. Aquatic Toxicity

Acute Studies

Three reliable OECD guideline studies are available for calcium sulphate dihydrate which were conducted at a limit test of 100 mg/L. Table 3 lists the results of acute toxicity studies on calcium sulphate dihydrate.

Table 3 Acute Aquatic Toxicity Studies on Calcium Sulphate Dihydrate

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Oryzias latipes	96-hour LC_{50}	>100	1	OECD 2003
Daphnia magna	48-hour EC_{50}	>100	1	OECD 2003
Selenastrum capricornutum	72-hour EC_{50}	>100	1	OECD 2003

Chronic Studies

No studies are available.

C. Terrestrial Toxicity

No studies are available.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Calcium sulphate dihydrate is an inorganic substance. Biodegradation is not applicable. For the purposes of this PBT assessment, the persistent criteria are not considered applicable.

In aqueous solutions, the substance is moderately soluble, dissociating into calcium (Ca^{2+}) and sulphate (SO_4^{2-}) ions that are ubiquitous in the environment. These are essential to all living organisms (flora and fauna) and their intracellular and extra-cellular concentrations are actively regulated. Bioaccumulation is thus not expected. As a result, it does not meet the criteria for bioaccumulation.

No chronic toxicity data exist on calcium sulphate dihydrate; however, acute E(L)C_{50} values in fish, invertebrates, and algae are >1 mg/L. Thus, calcium sulphate dihydrate does not meet the screening criteria for toxicity.

The overall conclusion is that calcium sulphate dihydrate is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for calcium sulphate dihydrate.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Calcium sulphate dihydrate	10101-41-4	Not a PBT	No	No	NA	No	No	No	1	No Data	1
Calcium sulphate	7778-18-9	Not a PBT	No	No	NA	No	No	No	1	No Data	1
Calcium sulphate hemihydrate	10034-76-1	Not a PBT	No	No	NA	No	No	No	1	No Data	1
Gypsum	13397-24-5	Not a PBT	No	No	NA	No	No	No	1	No Data	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICIS	Australian Industrial Chemicals Introduction Scheme
AICS	Australian Inventory of Chemical Substances
BCF	bioconcentration factor
COC	constituent of concern
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
hPa	hectopascal
IUPAC	International Union of Pure and Applied Chemistry
kg/m^3	kilogram per cubic metre
kPa	kilopascal
LC	lethal concentration
NOEC	no observed effective concentration
OECD	Organisation for Economic Co-operation and Development
Pa	Pascal
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals

SGG	Synthetic Greenhouse Gases
SIDS	Screening Information DataSet

CELLULOSE

This dossier on cellulose presents the most critical studies pertinent to the risk assessment of this substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed cellulose in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to human health or the environment.[1] [2]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): Cellulose

CAS RN: 9004-34-6

Molecular formula: $(C_6H_{10}O_5)n$

Molecular weight: 160,000 – 560,000 g/mol

Synonyms: cellulose crystalline; Sigmacell; microcrystalline cellulose

SMILES: Unspecified

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of Cellulose

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Odorless, white powdery fibres	-	NCBI, 2026
Melting Point	260-270°C (pressure not provided)	-	NCBI, 2026
Boiling Point	Decomposes before boiling	-	NCBI, 2026
Density	1,270-1,610 kg/m³ (temperature not provided)	-	NCBI, 2026
Vapour Pressure	0 Pa (temperature not provided)	-	NCBI, 2026
Partition Coefficient (log K_{ow})	Not available	-	-
Water Solubility	Insoluble (numeric value not provided)	-	NCBI, 2026
Flash Point	Not available	-	NCBI, 2026
Auto flammability	Not available	-	NCBI, 2026

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=534c433e-f36b-1410-8924-008e64e216c7
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=fbea433e-f36b-1410-8e4e-00f1fcf8411a

Property	Value	Klimisch Score	Reference
Viscosity	Not applicable, substance is a solid	-	-
Henry's Law Constant	Not applicable	-	-

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Cellulose is biodegradable, not expected to bioaccumulate, and in the terrestrial environment is expected to become part of the organic carbon pool in the soil where it will act as an important physical and chemical constituent.

B. Biodegradation

Cellulose is broken down by cellulolytic microorganisms including bacteria, fungi and some anaerobic protozoa and slime. In cellulosic wastes, cellulolytic microorganisms can establish synergistic relationships with noncellulolytic species which result in the complete degradation of cellulose. Under aerobic conditions, carbon dioxide and water are released, whereas carbon dioxide, methane and water are released under anaerobic conditions (DoEE, 2017).

C. Environmental Distribution

Plant-based materials distributed in the terrestrial environment are expected to become part of the organic carbon pool in the soil where it will act as an important physical and chemical constituent. Vegetation is the primary supplier of organic carbon to the soil, with organic carbon concentrations above 2% preferred for productive agricultural soils. Once in soils, organic carbon plays an essential role in retaining nutrients, soil moisture, improving soil structure, and supplying nutrients (DoEE, 2017).

Organic carbon is also critical to the functioning of aquatic ecosystems, with between 70 and 80% of the organic carbon in aquatic ecosystems in the form of humic and fulvic acids. These acids are produced as a result of the degradation of lignin and cellulose in both oxic and anoxic environments (DoEE, 2017).

D. Bioaccumulation

No bioaccumulation studies were located on cellulose. Cellulose is not expected to bioaccumulate due to its high molecular weight and potential for complete degradation in the environment.

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Studies on the absorption, distribution, metabolism, and excretion (ADME) of orally ingested cellulose and its derivatives concluded that this material passes unchanged through the gastrointestinal tract following oral administration. Cellulose materials do not have acute oral or dermal toxicity potential; it was also nonirritating to the skin and minimally irritating to eyes. Cellulose materials did not produce any responses indicative of sensitisation. Cellulose materials were shown to have low repeated-dose toxicity potential in subchronic and chronic exposures. In

addition, these products are not genotoxic or mutagenic and, do not cause reproductive / developmental toxicity.

B. Metabolism

The ADME of orally ingested cellulose and its derivatives have been studied extensively. Cellulose derivatives pass unchanged through the gastrointestinal tract following oral administration in rats, dogs, and man (CIR, 2009).

C. Acute Toxicity

Oral

Acute toxicity of read-across substance Hydroxypropyl Methylcellulose Acetate/Succinate (HPMCAS) was investigated in rabbits and rats. No deaths or behavioural abnormalities were observed with a single oral dose of 2,500 mg/kg (CIR, 2009).

An acute oral LD test was conducted on a 50% (wt/vol) solution of read-across substance hydroxyethylcellulose in corn oil. Doses of 6,834, 10,250, 15,380, and 23,070 mg/kg were administered by oral intubation to groups of 4 rats. After a 16-day observation period, all rats were necropsied. No deaths or gross pathological changes were noted. Reactions included hypoactivity and ruffed fur in all groups and diarrhea for 2 days in rats of the highest dose group (CIR, 2009).

Read-across substance cellulose gum administered to rats, rabbits, and guinea pigs in single oral doses of 3,000 mg/kg produced no toxic effects or deaths (CIR, 2009).

Acute oral LD50 of read-across substance cellulose gum was approximately 27,000 mg/kg in rats and 16,000 mg/kg in guinea pigs (CIR, 2009).

Dermal

Read-across substance hydroxypropylcellulose at 0.8% in an antiperspirant, was tested for dermal toxicity. A single occlusive patch containing 5,000 mg/kg of the amount of formulation was applied to each of 6 rabbits. No deaths occurred and no dermal irritation or gross effects were noted at the 14-day necropsy. The product was considered nontoxic by a single dermal exposure at a dose 500 times the expected human exposure (CIR, 2009).

D. Irritation

Skin

A primary skin irritation test was conducted on read-across substances hydroxyethylcellulose (2%; two samples), hydroxypropylcellulose (2%), methylcellulose (2%; three samples), and cellulose gum (1, 4, and 10%). Aqueous solutions of each cellulose derivative were prepared and preserved with sodium paraben (0.15%) and propylparaben (0.05%). Each solution (0.5 ml) was applied on two patch areas, the right (scarified) and left (intact) flanks of male albino rabbits (6/group). Patches were occluded for 23 h, removed, and readings (scale of 0 to 8) taken 1 and 48 h later. The Primary Irritation Indices (PII) ranged from 0.04 to 0.21 (max = 8). Each of these cellulose derivatives, under these conditions, were nonirritating (CIR, 2009).

Eye

Read-across substance hydroxyethylcellulose was evaluated for ocular irritation in two Draize tests. Each test was conducted on 8 rabbits: 4 rabbits had their eyes rinsed for 2 min after a 1-min exposure period, and 4 had unrinsed eyes. In the first test, 100 mg of 100% hydroxyethylcellulose was instilled into each rabbit eye. A dose of 0.1 ml of a 2% (wt/vol) solution of hydroxyethylcellulose in water was administered in the second test. Eyes were scored according to Draize at 1, 24, and 72 h and 7 days. Mean scores at 1 h for the rinsed and unrinsed eyes of those rabbits receiving 100% hydroxyethylcellulose were 4.0 and 10.0, respectively; means at all subsequent readings were 0. Those rabbits receiving 2% (wt/vol) hydroxyethylcellulose had 1-h means of 2.5 and 2.0 for the rinsed and unrinsed eyes, respectively; means at all subsequent readings were 0. Thus, hydroxyethylcellulose was initially minimally irritating to rabbit eyes; however, all irritation had cleared by 24 h (CIR, 2009).

E. Sensitisation

Read-across substance hydroxyethylcellulose was evaluated for sensitisation using a guinea pig maximization test. Thirty guinea pigs were used: 10 experimental, 10 untreated, and 10 positive control treated with mercaptobenzothiazole. Each animal received three intradermal injections into the shaven shoulder consisting of 0.1 ml of 50% complete Freund's adjuvant in saline, 0.1 ml of 1% hydroxypropylmethylcellulose in saline, and 0.1 ml of 1% hydroxypropylmethylcellulose in 50% complete Freund's adjuvant in saline. One week later, the same area was pretreated with 10% sodium lauryl sulphate (SLS) in petrolatum and occlusively patched for 48 h with 25% hydroxypropylmethylcellulose in petrolatum. Following a 2-week rest, a 24-h occlusive challenge patch containing 25% hydroxypropylmethylcellulose in petrolatum was applied to the shaven flank of each animal. The control guinea pigs also received the challenge application. Reactions were scored 24 and 48 h after patch removal. Hydroxypropylmethylcellulose did not produce any responses indicative of sensitisation and was considered a nonsensitiser (CIR, 2009).

F. Repeated Dose Toxicity

Oral

Diets containing 0.2, 1.0, and 5.0% read-across substance hydroxyethylcellulose were fed to three groups of 20 rats for 90 days. Two groups/sex were kept as controls. Feed consumption and weight gain were monitored weekly; behaviour was checked daily. Blood and urine samples were collected from 5 males and 5 females in each group on days 0, 21, 45, and 90. Necropsy was performed on all animals, and tissues were examined microscopically from 5 males and 5 females from both control groups and the 1.0 and 5.0% groups. No significant findings attributable to ingestion of hydroxyethylcellulose were noted (CIR, 2009).

The oral toxicity of hydroxypropylcellulose was evaluated in rats fed a diet containing the cellulose derivative at a concentration of 0.2, 1.0, or 5.0% for 90 days. Each test group consisted of 5 male and 5 female rats. Control groups received 0.2, 1.0, or 5.0% Cellulose diets. No differences between the control and treated groups were noted in survival, growth, behaviour, food consumption and utilization, hematopoietic and urinary function analyses, organ weights and organ weight ratios, or in the gross and microscopic examination of tissues (CIR, 2009).

A 2-year chronic oral toxicity test was conducted with male and female Wistar strain rats. The animals received diets containing 0.2, 1, or 5% hydroxyethylcellulose. The resulting mean dosages were, respectively, 0.09, 0.41, and 2.31 g/kg per day. Offspring were kept until at least 10 of each sex representing 10 litters from each dosage group had attained a weight of 40 g. These rats were maintained on the test diet until the end of the study, bringing the total number of rats for each dosage group to 52. A control group was maintained on the basic diet, free of hydroxyethylcellulose.

Criteria evaluated included growth, feed intake, life span, frequency of infections, body weights, kidney and liver weights, number of litters, haematological values, incidence of neoplasms, and microscopic alterations of numerous organs. Forty-eight percent of the rats died during the 2-year period; however, the investigators found "every death was caused by a recognizable factor distinct from the doses" and that fatalities were evenly distributed over the test and control groups. The feed intake of the rats fed the 5% hydroxyethylcellulose diet was one tenth greater than that of the other groups. Their faeces were noted to be almost white and bulkier than normal due to the large content of undigested cellulose ether. None of the other criteria evaluated revealed any relationship between dose and response (CIR, 2009).

Inhalation

No data available

Dermal

A consumer product containing 3.0% read-across substance cellulose gum was evaluated for dermal toxicity in rats. Fifteen rats (males and females) received a daily dose of 886 mg/kg (0.9 ml/kg) of the product 5 days per week for 13 weeks. This was a dose set at 100 times the average daily human use level. Control groups consisted of untreated rats and rats treated with ethanol. Each dose was applied by inunction to an anterior dorsal shaved site on each rat. The product was wiped off 1 h after application because the active agent, sodium silicate, was a known irritant. No significant adverse effects were noted in mortality, body weights, haematological values and urinalyses, organ weights, and gross and microscopic examination. Scattered transient minimal skin irritation was noted in most test animals during weeks 2 through 6. The investigators concluded that the product was safe for marketing (CIR, 2009).

G. Genotoxicity

In Vitro Studies

No studies were available for cellulose. The *in vitro* genotoxicity studies on cellulose derivatives are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on Cellulose derivatives

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Methylcellulose: Ames test (*Salmonella typhimurium*)	-	-	—	CIR, 2009
Methylcellulose: host-mediated assay	-	-	—	CIR, 2009
Methylcellulose: dominant lethal assay	-	-	—	CIR, 2009

*+, positive; -, negative

In Vivo Studies

No data available

H. Carcinogenicity

Oral

No data available

Inhalation

No data available

Dermal

No data available

I. Reproductive Toxicity

The reproductive effects of read-across substance hydroxypropylcellulose were studied in both rabbits and rats. Doses of 0, 200, 1000, and 5000 mg hydroxypropylcellulose/kg per day were administered by stomach tube to groups of 12, 11, 11, and 12 Himalayan rabbits, respectively, on days 6-18 of gestation. Hydroxypropylcellulose was suspended in 1% gum arabic solution; controls received 10 mg/kg of the vehicle. The low dose represented 10 times the human use level, and the high dose was the largest amount of substance technically possible to administer by stomach tube. Caesarean sections were performed on the 29th day of gestation. All of the foetuses were examined for skeletal and organ malformations. No embryotoxic or teratogenic effects were noted, and no adverse influence on behaviour, appearance, and growth of the maternal rabbits was observed (CIR, 2009).

Wistar rats received similar doses of hydroxypropylcellulose, 0, 200, 1000, and 5000 mg/kg per day by stomach tube on days 7-17 of gestation. Hydroxypropylcellulose was suspended in 1% gum arabic solution; the controls received 62.5 ml/kg of the vehicle. The low and high doses represented 10 and 250 times the human use level, respectively. On day 21 of gestation, caesarean sections were performed on 21-24 rats in each dose group; the remaining 12-15 rats in each dose group were allowed to deliver spontaneously. Those pups delivered spontaneously were weaned at 28 days, and 2 males and 2 females from each litter were 1 randomly selected for F generation reproduction studies. No significant embryotoxic or teratogenic effects nor abnormalities 1 in foetal skeletal development and F generation reproductive abilities were noted. The no observed adverse effect level (NOAEL) was determined to be 5000 mg/kg bw/ day, the highest dose tested (CIR, 2009).

J. Developmental Toxicity

Oral

Groups of 20 pregnant Sprague-Dawley rats and New Zealand White rabbits were dosed with 0, 50, 150, 625, or 2500 mg/kg read-across substance HPMCAS from gestational day (GD) 6-17 or GD 7-19 for rats and rabbits, respectively. Foetuses were collected by caesarean section and examined for external, visceral and skeletal development. No developmental toxicity was observed as a result of HPMCAS exposure demonstrating that maternal HPMCAS exposure during gestation does not induce developmental anomalies. The NOAEL was determined to be 2500 mg/kg bw/ day, the highest dose tested (CIR, 2009).

Inhalation

No data available

Dermal

No data available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for cellulose follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

Cellulose is a linear glucose homopolymer consisting of glucopyranose units linked by b-1,4-glycosidic bonds. It is the chief constituent of plant fibres, cotton being the purest natural form of the substance. Cellulose materials were shown to have no dose response in subchronic and chronic exposures. When there is no relevant systemic exposure, there can be no response regardless of the type of toxicological endpoint. As a result, an oral reference dose and corresponding drinking water guideline value were not derived.

B. Cancer

There are no studies available. However, cellulose is not genotoxic or mutagenic. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Cellulose is a combustible solid (NCBI, 2026). However, it does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Cellulose is of low toxicity concern to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Woody materials, including cellulose, that have not been chemically treated are not considered to be directly toxic to biota. Nevertheless, organic matter such as cellulose can act as non-toxic stressors that have direct or indirect effects on aquatic ecosystems. However, in the aquatic environment, cellulose is expected to become part of the aquatic carbon cycle (DoEE, 2017).

C. Terrestrial Toxicity

No data are available.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Cellulose is readily biodegradable; thus, it does not meet the screening criteria for persistence.

Cellulose is not expected to bioaccumulate due to its high molecular weight and potential for complete degradation in the environment. Thus, cellulose does not meet the screening criteria for bioaccumulation.

In the aquatic environment, cellulose is expected to become part of the aquatic carbon cycle. Thus, cellulose does not meet the screening criteria for toxicity.

The overall conclusion is that cellulose is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Not classified

B. Labelling

No signal word

C. Pictogram

None identified

X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

If this chemical contacts the eyes, immediately wash (irrigate) the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately.

Skin Contact

If this chemical contacts the skin, wash the contaminated skin with soap and water.

Inhalation

If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. Other measures are usually unnecessary.

Ingestion

None.

B. Fire Fighting Information

None

C. Accidental Release Measures

None

D. Storage And Handling

None.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard for cellulose has not been established in Australia.

Engineering Controls

None.

Personal Protection Equipment

Respiratory Protection: None.

Hand Protection: None..

Skin Protection: None..

Eye protection: None..

F. Transport Information

Cellulose is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

Australian Drinking Water Guidelines [ADWG]. (2011). National Water Quality Management Strategy. Australian Drinking Water Guidelines, Section 6, Australian Government, National Health and Medical Research Council, Natural Resource Management Ministerial Council. Updated June 2025. https://www.nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines

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CERAMIC MATERIALS & WARES, CHEMICALS [CAS RN 64402-68-4]
KAOLIN [CAS RN 1332-58-7]

This dossier on Ceramic Materials & Wares, chemicals (CMW) and related substance kaolin presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam and shale gas extraction activities. Limited information is available for kaolin, however, it is expected to have similar environmental concerns as CMW.

This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – CMW and kaolin are classified as **tier 1** chemicals and requires a hazard assessment only.

1 BACKGROUND

CMW is a UVCB substance. The group consists of products made by baking or firing non-metallic minerals (clay and similar materials). This category encompasses the various chemical substances manufactured in the production of ceramics. For purposes of this category, a ceramic is defined as a crystalline or partially crystalline, inorganic, non-metallic, usually opaque substance consisting principally of combinations of inorganic oxides of aluminum, calcium, chromium, iron, magnesium, silicon, titanium, or zirconium which conventionally is formed first by fusion or sintering at very high temperatures, then by cooling, generally resulting in a rigid, brittle monophase or multiphase structure (USEPA, 2026).

CMW is an inorganic solid. As an inorganic substance, biodegradation is not applicable. Inorganic oxides associated with CMW are so firmly bonded in the substance's chemical lattice that it lacks any relevant solubility. CMW has a low potential for bioaccumulation (highly insoluble in water and fat) and direct and indirect exposure of the aquatic compartment is unlikely.

CMW is of low toxicity concern to aquatic and terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Ceramic Materials & Wares, chemicals

CAS RN: 64402-68-4

Molecular formula: Not applicable (UVCB substance)

Molecular weight: Not applicable (UVCB substance)

Synonyms: Antimony oxide calcium titanate silicate ceramic opacifier; Barium calcium magnesium strontium aluminum silicate flux: Calcined bauxite: Calcined clay: Calcined clays: Calcined fireclay: Calcined kaolin

Chemical Name (IUPAC): Sialuminum;trioxido(trioxidosilyloxy)silane;dihydrate

CAS RN: 1332-58-7

Molecular formula: $H_2Al_2Si_2O_8 \bullet H_2O$ or $Al_2H_4O_9Si_2$

Molecular weight: 258.16 g/mol

Synonyms: Kaolin; Weisserton; Natural kaolin; Red halloysite; Kaolin light; Alumina silicate; Hydrated aluminium silicate; Porcelan Clay: Pectin and Kaolin

3 PHYSICO-CHEMICAL PROPERTIES

Limited information for kaolin is available. Key physical and chemical properties for CMW are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of CMW

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Dark grey/black crystalline solid	1	ECHA
Melting Point	>1650 °C	1	ECHA
Boiling Point	Not applicable for solids which melt above 300 °C	-	ECHA
Density	3820 kg/m^3 @ 20°C	1	ECHA
Vapor Pressure	Not applicable for solids which melt above 300 °C	-	ECHA
Partition Coefficient (log K_{ow})	Not applicable as substance is inorganic	-	ECHA
Water Solubility	0.00005 g/L @ 20°C	1	ECHA
Dissociation constant (pKa)	Not relevant	-	ECHA
Viscosity	Not applicable, substance is a solid	-	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for CMW or kaolin.

NICNAS has assessed kaolin in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to human health and the environment.[1][2]

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=6148433e-f36b-1410-8924-008e64e216c7
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=e48c433e-f36b-1410-8c14-0026b2c59b62

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

CMW is an inorganic solid. As an inorganic substance, biodegradation is not applicable. Inorganic oxides associated with CMW are so firmly bonded in the substance's chemical lattice that it lacks any relevant solubility. If released to water, the dissolved metal ions from CMW do not exceed the concentration of metal ions in natural surface waters. The solubility of aluminium and iron in the CMW spinel is < 0.05 mg/L. Further, after distribution in the environment it would be impossible to make a distinction between CMW and other natural occurring minerals comprising magnesium, iron and aluminium oxides. Each deposit would be covered by the huge amount of minerals, which build the sediment in the surface water or the earth´s crust. Aluminium is the is the most abundant metal in the Earth's crust, and the third most abundant element therein, after oxygen and silicon. It makes up about 8% by weight of the Earth's solid surface (ECHA).

There are no bioaccumulation studies on CMW. CMW has a low potential for bioaccumulation (highly insoluble in water and fat), and direct and indirect exposure of the aquatic compartment is unlikely (ECHA).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

CMW is of low toxicity concern to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Aquatic toxicity is unlikely to occur. CMW is highly insoluble in water. The dissolved metal ions, i.e. Al3+ and Fe2+ from the test substance do not exceed the concentration of metal ions in natural surface waters. The solubility of the ions from the CMW lattice is <0.05 mg/L and < 0.05 mg/L for aluminium and iron, respectively, below anticipated environmentally relevant conditions.

In literature, the following is noted:

- The acute toxicity of soluble aluminium salts to fish ranges from 0.095 to 235 mg/L (96-hr LC_{50}). The acute toxicity to fish for soluble iron salts ranges from 0.3 to 2.0 mg/L (96-h LC_{50}). Therefore, it can be clearly shown that the solubility of CMW is obviously well below these measured effect concentrations (at least 2 times below for aluminium) (ECHA).

- The acute toxicity of soluble aluminium chloride to aquatic invertebrates ranges from 0.48 to 59.6 mg/L (96-hr LC_{50} values). The acute toxicity to aquatic invertebrates for soluble iron salts ranges from 33 to 100 mg/L (96-hr LC_{50}). Therefore, it can be clearly shown that the solubility of CMW is obviously well below these measured effect concentrations (at least more than 9 times below for aluminium) (ECHA).
- A toxicity threshold for soluble aluminium chloride towards algae of 0.1 to 2 mg/L can be found. For soluble iron chloride a NOEC value of 3.0 mg/L is documented. It can therefore be clearly stated that the solubility of CMW is obviously well below these measured effect concentrations (at least 2 times below for aluminium) (ECHA).

Therefore, testing fish, invertebrate and algae toxicity is scientifically not justified (ECHA).

C. Sediment Toxicity

No data available. Exposure of sediment is unlikely (ECHA).

D. Terrestrial Toxicity

No data available. Direct and indirect exposure of soil is unlikely (ECHA).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

CMW is an inorganic substance. Thus, biodegradation is not applicable to this substance. For the purposes of this PBT assessment, the persistent criteria are not considered applicable to CMW.

CMW has a low potential for bioaccumulation (highly insoluble in water and fat) and direct and indirect exposure of the aquatic compartment is unlikely. Thus, it does not meet the screening criteria for bioaccumulation.

The lowest chronic NOEC for <insert chemical name>is >0.1 mg/L. The acute $E(L)C_{50}$ values are >1 mg/L. Thus, <insert chemical name>does not meet the screening criteria for toxicity.

CMW has a low potency with respect to environmental toxicity. CMW is highly insoluble in water. The dissolved metal ions, i.e. Al3+ and Fe2+ from the test substance do not exceed measured effect concentrations in fish, invertebrates and algae. Thus, CMW does not meet the screening criteria for toxicity.

The overall conclusion is that CMW is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for CMW. .

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
Ceramic materials and wares, chemicals	64402-68-4	Not a PBT	No	No	NA	No	No	No	1	No Data	1
Kaolin	1332-58-7	Not a PBT	No	No	No	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICIS	Australian Industrial Chemicals Introduction Scheme
AICS	Australian Inventory of Chemical Substances
COC	constituent of concern
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
Kl	Klimisch scoring system
kPa	kilopascal
L	litre
L/kg	litres per kilogram
LC	lethal concentration
LD	lethal dose

m^3	cubic metre
mg/kg	milligrams per kilogram
mg/L	milligrammes per litre
mg/m^3	milligrams per cubic metre
mL	millilitre
mPa s	millipascal second
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

C.I. BASIC VIOLET 10 (RHODAMINE B OR D&C RED NO 19)

This dossier on C.I. Basic Violet 10 (Rhodamine B or D&C Red No 19) presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – C.I. Basic Violet 10 is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

C.I. Basic Violet 10 is an organic chloride salt having *N*-[9-(2-carboxyphenyl)-6-(diethylamino)-3*H*-xanthen-3-ylidene]-*N*-ethylethanaminium as the counterion. An amphoteric dye commonly used as a fluorochrome. It is often used as a tracer dye within water to determine the rate and direction of flow and transport. Rhodamine dyes fluoresce and can thus be detected easily and inexpensively with fluorometers. It is an organic chloride salt and a xanthene dye. It contains a rhodamine B(1+).

C.I. Basic Violet 10 (Rhodamine B or D&C Red No 19) is not readily biodegradable. It has a low potential for bioaccumulation. It is not expected to strongly adsorb to soil, suspended solids or sediment.

C.I. Basic Violet 10 (Rhodamine B or D&C Red No 19) is of low toxicity concern to aquatic organisms and moderate toxicity concern to terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): 9-(2-carboxyphenyl)-3,6-bis(diethylamino)xanthen-10-ium chloride

CAS RN: 81-88-9

Molecular formula: $C_{28}H_{31}ClN_2O_3$

Molecular weight: 479.02 g/mol

Synonyms: Rhodamine B; Xanthylium; 9-(2-carboxyphenyl)-3,6-bis(diethylamino)-, chloride; Ammonium; [9-(o-carboxyphenyl)-6-(diethylamino)-3H-xanthen-3-ylidene]diethyl-, chloride; C.I. Basic Violet 10

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of CI Basic Violet 10

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Green crystals or reddish-violet powder	-	NCBI, 2026
Melting Point	>172 and <176°C @ 101.3 kPa	2	ECHA
Boiling Point	431°C @101.3 kPa (predicted)	-	USEPA, 2026a
Density	1310 kg/m^3 (temperature not specified)	-	[1]
Vapor Pressure	2.853 Pa @25°C	-	USEPA, 2026a
Partition Coefficient (log K_{ow})	>1.9 and <2 (QSAR)	2	ECHA
Water Solubility	10 g/L (pH and temperature not reported)	2	ECHA
Dissociation constant (pKa)	3.2 @ 25°C	-	NCBI, 2026
Viscosity	Not applicable, substance is a solid	-	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for CI Basic Violet 10.

NICNAS has assessed CI Basic Violet 10 in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to the environment[2] .

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

[1] Rhodamine B. *CAS Common Chemistry*. CAS, a division of the American Chemical Society, n.d. https://commonchemistry.cas.org/detail?cas_rn=81-88-9 (retrieved 2026-07-29) (CAS RN: 81-88-9). Licensed under the Attribution-Noncommercial 4.0 International License (CC BY-NC 4.0).

[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=6e68433e-f36b-1410-8de4-00e8f2afc108

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

C.I. Basic Violet 10 (Rhodamine B or D&C Red No 19) is not readily biodegradable. It has a low potential for bioaccumulation. It is expected to not strongly adsorb to soil, suspended solids or sediment.

B. Biodegradation

C.I. Basic Violet 10 (Rhodamine B or D&C Red No 19) is not readily biodegradable. In an activated sludge study, there was 0% degradation after 28 days, as determined by oxygen consumption (ECHA) [KI. Score = 2].

If a chemical is found to be not readily biodegradable, it is categorised as Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

No experimental data are available for C.I. Basic Violet 10. Using KOCWIN in EPISUITE™ (USEPA, 2019), the estimated soil organic carbon partition coefficient (K_{oc}) value for C.I. Basic Violet 10 from log K_{ow} is 15.52 L/kg. The estimated K_{oc} value from the molecular connectivity index (MCI) is 1.2×10^7 L/Kg.

If released to soil, based on the low end of the K_{oc} values, the substance is expected to not sorb to soils and have high mobility. If released to water, based on the K_{oc} values and its high water solubility, it is expected to similarly not adsorb to suspended solids and sediment.

D. Bioaccumulation

Based on a log K_{ow} of 1.95, C.I. Basic Violet 10 (Rhodamine B or D&C Red No 19) has low potential for bioaccumulation (ECHA). This is supported by a low measured bioconcentration factor (BCF) range of 0.2 to 1.7 L/kg in carp[3].

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

C.I. Basic Violet 10 (Rhodamine B or D&C Red No 19) is a low toxicity concern to aquatic organisms and a moderate toxicity concern to terrestrial organisms.

[3] https://wwwp.ymparisto.fi/scripts/Kemrek/Kemrek_uk.asp?Method=MAKECHEMdetailsform&txtChemId=1045

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of representative acute aquatic toxicity studies conducted on C.I. Basic Violet 10 (Rhodamine B or D&C Red No 19).

Table 3: Acute Aquatic Toxicity Studies on C.I. Basic Violet 10 (Rhodamine B or D&C Red No 19)

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Oryzias latipes (Japanese rice fish)	48-hr LC_{50}	Between 12 and 33.9	2	ECHA
Daphnia magna (Water flea)	48-hr LC_{50}	22.9 (mortality)	-	ECOTOX

Chronic Studies

No studies available.

C. Terrestrial Toxicity

In a phytotoxicity study with *Lactuca sativa* in soil and nutrient solution, a 14-day EC_{50} value of 43 mg/kg soil indicates moderate toxicity for plant growth (ECOTOX).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

CI Basic Violet 10 is not readily biodegradable; thus, it does meet the screening criteria for persistence.

Based on a log K_{ow} of 1.95, CI Basic Violet 10 does not meet the screening criteria for bioaccumulation.

No chronic aquatic toxicity studies are available for CI Basic Violet 10. Acute $E(L)C_{50}$ values in fish and invertebrates are >1 mg/L. Thus, CI Basic Violet 10 does not meet the screening criteria for toxicity.

The overall conclusion is that CI Basic Violet 10 is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for CI Basic Violet 10.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
C.I. Basic Violet 10 (Rhodamine B or D&C Red No 19)	81-88-9	Not a PBT	No	No	Yes	No	No	No	1	No data	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
COC	constituent of concern
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
KI	Klimisch scoring system
KOCWIN™	USEPA organic carbon partition coefficient estimation model
kPa	kilopascal
L	litre
L/kg	litres per kilogram
LC	lethal concentration
LD	lethal dose
m^3	cubic metre
MCI	molecular connectivity index
mg/kg	milligrams per kilogram
mg/L	milligrammes per litre
mg/m^3	milligrams per cubic metre
mL	millilitre
mPa s	millipascal second
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

MIXTURE OF 5-CHLORO-2-METHYL-2H-ISOTHIAZOL-3-ONE AND 2-METHYL-2H-ISOTHIAZOL-3-ONE (3:1)

This dossier on the mixture of 5-chloro-2-methyl-2h-isothiazolol-3-one (CMIT) and 2-methyl-2h-isothiazol-3-one (MIT) (3:1) presents the most critical studies pertinent to the risk assessment of the mixture in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – CMIT and MIT were not identified in chemical databases used by NICNAS as an indicator that the chemicals are of concern and are not PBT substances. The mixture of CMIT and MIT were assessed as tier 3 chemicals for acute and chronic aquatic toxicity. Therefore, CMIT/MIT are classified overall as **tier 3** chemicals and require a quantitative risk assessment for end uses.

1 BACKGROUND

The methylisothiazolinones in this assessment belong to a larger group of preservatives and industrial biocides, which all have an isothiazolinone heterocyclic ring system. CMIT is the monochloro derivative of parent chemical MIT.

Methylisothiazolinones are made industrially by oxidative cyclisation of the linear organic di-sulfide, N,N’-dimethyl-3,3’-dithiodipropionamide (CAS RN 999-72-4), in a process that uses chlorine as the oxidant. This manufacturing process inevitably produces a mixture of MIT and CMIT, as well as a small amount of the dichloro derivative (DCMIT; CAS RN 26542-23-4). These mixtures are generally not separated into their constituent chemicals and CMIT is not commercially available except as a mixture with MIT (NICNAS, 2020).

The mixture of CMIT and MIT is biodegradable at expected environmental exposure concentrations and would also be removed by common biological wastewater treatment facilities. The mixture is not expected to bioaccumulate and has a low potential to adsorb to soil.

The acute toxicity of CMIT/MIT is moderate to highly toxic by the oral, inhalation and dermal routes. It is corrosive to the skin and eye and is expected to be a skin sensitiser according to a local lymph node assay. Repeated exposures to rats by the oral, dermal, or inhalation routes have shown no systemic toxicity; however, evidence of localised irritation (site-of-contact) was observed by all routes of exposure. CMIT/MIT may exhibit weak genotoxic effects in some *in vitro* tests, whereas the *in vivo* studies consistently show no genotoxic activity. It has no reported reproductive or developmental effects and not considered carcinogenic.

The mixture of CMIT and MIT exhibits significant acute and chronic aquatic toxicity. The mixture is also toxic to sediment dwelling organisms but less toxic to terrestrial receptors.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Reaction mass of 2-methyl-2H-isothiazol-3-one and 5-chloro-2-methyl-2H-isothiazol-3-one

CAS RN: 55965-84-9

Molecular formula: C_4H_5NOS. C_4H_4ClNOS

Molecular weight: 264.8 g/mol

Synonyms: Bio-Perge; Isothiazolinone chloride; 5-Chloro-2-methyl-4-isothiazolin-3-one -2-methyl-4-isothiazolin-3-one mixture; 3(2H)-Isothiazolone, 5-chloro-2-methyl-, mixt. with 2-methyl -3 (2H) -isothiazolone

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for these substances are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Mixture of CMIT and MIT (3:1)

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Solid, pale yellow to yellow	1	ECHA
Melting Point	22.2°C at 101.3 kPa	1	ECHA
Boiling Point	100.1°C at 101.3 kPa	1	ECHA
Density	1,256 kg/m^3 @ 20°C	1	ECHA
Vapor Pressure	2.2 Pa @ 20°C	1	ECHA
Partition Coefficient (log K_{ow})	0.75 @ 27°C	1	ECHA
Water Solubility	3,000 g/L @ 20°C	1	ECHA
Dissociation Constant (pKa)	Does not dissociate	1	ECHA
Viscosity	11.4 mm^2/s	1	ECHA

Combined formulations of CMIT and MIT are marketed under several trade names, such as Kathon CG, Kathon 886, Kathon 886 WT, Kathon™ 886, ACTICIDE LG, ACTICIDE 14 L, ACTICIDE 14P, Microcare IT, Microcare ITL, etc. (EU SCCS, 2009). Initially, all formulations were prepared as a mixture of two individual active ingredients CMIT and MIT and salts. However, Kathon™ 886 biocide is now defined as a combination of the two active ingredients produced by an integrated production process, resulting in an approximate total of 14% active ingredients, 16% magnesium nitrate, 10% magnesium chloride and 62% water. There is no indication as to when this change was made in the manufacturing process (EU SCCS, 2009).

As such, magnesium nitrate and magnesium chloride are present in the commercial CMIT/MIT mixture as an inert ingredient and impurity, respectively. The amount of these two salts varies depending on the source (EU SCCS, 2009).

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for the mixture of CMIT and MIT.

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

The mixture of CMIT and MIT is biodegradable at expected environmental exposure concentrations, is not expected to bioaccumulate, and has a low potential to adsorb to soil.

B. Partitioning

The mixture of CMIT and MIT is readily soluble in water. Given low Henry's Law constants for MIT and CMIT (0.005 Pa-m^3/mol and 0.0036 Pa-m^3/mol, respectively), these chemicals are considered slightly volatile from water and moist soil. The mixture is also expected to volatilise from dry soil surfaces based upon its vapour pressure.

Based on hydrolysis measurements made using OECD Guideline 111, CMIT/MIT was stable (<10% degradation) at pH 4 and 7. At pH 9, extensive degradation of CIT/MIT was observed. The rate constant was found to be 0.0283 per day and the DT50 and DT90 to be 24.5 days and 81 days, respectively (ECHA). [Kl. Score = 1].

In the presence of sunlight, CMIT/MIT is susceptible to rapid photodegradation with DT50 and DT90 values of 117 and 389 hours, respectively. (ECHA). [Kl. Score = 1].

C. Biodegradation

The biodegradation of a 14% aqueous solution of 3 parts 5 -Chloro-2 -methyl-2H-isothiazol-3 -one and 1 part 2 -Methyl-2H-isothiazol-3 -one (cited as ACTICIDE® 14 in the study report) was investigated in a closed-bottle seawater test (OECD guideline 306). The test substance was incubated with natural seawater over a period of 28 days under aerobic conditions, and oxygen content was determined by means of an oxygen electrode after 0, 5, 15 and 28 days. ACTICIDE® 14 can be

considered inhibitory to bacteria in the seawater sample. Due to inhibition of bacteria, the biodegradability of ACTICIDE® 14 could not be established in this test (ECHA). [Kl. Score = 1].

Biodegradation studies on CMIT and MIT separately have also been conducted. In these studies, CMIT is classified as being readily biodegradable; however, it failed the 10 -day window. MIT is classified as being not readily biodegradable according to the criteria of the test, although significant biodegradation occurred (ECHA).

An OECD Guideline 301 B (Ready Biodegradability: CO2 Evolution Test) was performed on MIT. 50% of the test substance biodegraded within 29 days. Although extensive metabolism occurs over the 29-day interval, the test material does not meet the requirements for readily biodegradable but can be considered ultimately biodegradable. [Kl Score=1](ECHA). The same test with CMIT showed up to 62% of the test substance biodegraded within the same time frame of 29 days. [Kl Score=1](ECHA). The rate of biodegradation in these tests does not satisfy the OECD criterion for readily biodegradability (60% in a 10-day window), but the results do show that these chemicals are biodegradable at more realistic environmental exposure concentrations (NICNAS, 2020).

The primary aerobic biodegradability of MIT has been examined in a river sediment-water system by use of a 14^{C}-labelled model compound. During the 7-day experiment 14^{C}-labelled MIT was rapidly metabolized as only 12.6% of the initial MIT was present after 24 hours of incubation at 25°C. The calculated half-life for the parent compound was 9.1 hours (Reynolds, 1994a). The primary biodegradability of CMIT has been examined with the same type of sediment and water as described for MIT. The 14^{C}-labelled CMIT was rapidly metabolized as only 30% of the initial CMI remained after 24 hours of incubation at 25°C. The calculated half-life for the intact CMIT was 17.3 hours (Reynolds, 1994b).

In soil, CMIT and MIT are rapidly biodegradable with reported half-lives of 10.4 hours and 6.5 hours, respectively (ECHA). [Kl. Score = 1].

If a chemical is found to be readily or inherently biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

D. Environmental Distribution

An OECD Guideline 106 test (Adsorption - Desorption Using a Batch Equilibrium Method) was conducted on the CMIT/MIT mixture. The adsorption/desorption characteristics of [14^{C}]-CMIT/MIT were studied in two UK sewage sludges: Basildon (pH 6.6, 29.3% organic carbon) and Chelmsford (pH 6.7, 23.7% organic carbon) and three UK soils, Farditch silt loam (pH 5.5, 4.19% organic carbon), Longwoods sandy loam (pH 7.1, 1.62% organic carbon) and Kenslow loam (pH 4.9, 3.88% organic carbon) using the batch equilibrium method. The Kfoc values obtained ranged from 34 to 54 mL/g (mean of 44 mL/g). The Freundlich exponents (1/n) ranged from 0.564 to 0.778, indicating a non-linear relationship between adsorption and concentration with a higher degree of adsorption to soil at lower concentrations. The determined Kf_{oc} values indicated that CMIT/MIT can be classified as being of intermediate to high mobility in soil. [Kl Score=1](ECHA).

Soil adsorption coefficients (K_{oc}) for MIT (log K_{oc} = 1.08) and CMIT (log K_{oc} – 1.28) indicate both chemicals will have very high mobility in soil (NICNAS, 2020). Likewise, if released to water, based on their high solubility, they are not expected to adsorb to suspended solids or sediments.

E. Bioaccumulation

Bioaccumulation studies are not available for the CMIT/MIT mixture. Individually, MIT and CMIT are not expected to bioaccumulate. Studies of the bioconcentration of MIT and CMIT in bluegill sunfish (Lepomis macrochirus) at an exposure concentration of 0.12 mg/L showed bioconcentration factors (BCF) in this species of 2.3 and 114 L/kg respectively (Madsen, et al., 2001).

The low bioconcentration potential, hydrophilicity, and the reactivity of both chemicals with biomolecules indicate that they will not biomagnify in aquatic or terrestrial food webs (NICNAS, 2020).

6 HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

The acute toxicity of CMIT/MIT is moderate to highly toxic by the oral, inhalation and dermal routes. It is corrosive to the skin and eye and is expected to be a skin sensitiser according to a local lymph node assay. Repeated exposures to rats by the oral, dermal, or inhalation routes have shown no systemic toxicity; however, evidence of localised irritation (site-of-contact) was observed by all routes of exposure. CMIT/MIT may exhibit weak genotoxic effects in some *in vitro* tests, whereas the *in vivo* studies consistently show no genotoxic activity. It has no reported reproductive or developmental effects and not considered carcinogenic.

B. Toxicokinetics and Metabolism

Rats were given by gavage a single dose of 3.75 milligrams per kilogram body weight (mg/kg bw), 11.25 mg/kg bw or 22.5 mg/kg bw radiolabelled CMIT. CMIT was rapidly and extensively excreted in the urine and faeces following oral administration. A majority of the radioactivity was excreted from the rats in 24 hour (77-87%). Renal and faecal routes of elimination were equally important. Tissues contained 0.93-1.44% (female and male, respectively) of dosed radioactivity in the low dose group and 3.94-4.72% (female and male, respectively) in the high dose group. The highest amount of radioactivity was found in blood, particularly in red blood cells (0.67-1.09% of the dose in the low dose group, and 3.41-4.11% in the high dose group), followed by muscle (0.15%) in low dose group, and by muscle and liver (0.25%) in high dose group. Gender differences in excretion appeared to be minimal. CMIT was extensively metabolized. Approximately twenty-nine radioactive components were observed in urine and faeces samples from the HPLC radio profiling. Among these N-methyl malonamic acid was detected as the major component in the urine (15.35-18.19%). 3 -mercapturic acid conjugate of 3 -sulfinyl-N-methyl-propionamide was detected as the major component in the feces (up to 32.54%). All other metabolites accounted for less than 5% of the dose. Metabolites are thought to result from reduction and oxidation reactions involving phase I enzymes followed by conjugation to glutathione, giving rise to conjugates to glutathione or to mercapturic acid. (ECHA). [Kl. Score = 1].

C. Acute Toxicity

Oral

An acute oral toxicity study was conducted before implementation of GLP protocols. Groups of CD rats were administered orally via gavage Kathon 886 at 221, 313, 442, 625 or 883 mg/kg b.w. Clinical

signs were observed in all dose levels of this study. Under the conditions of the study, the acute oral LD_{50} in male rats is based on the lowest value, 457 mg/kg Kathon 886 corresponding to 64 mg/kg active ingredient (a.i.) (pure CMIT/MIT). (ECHA). [KI Score = 2].

Inhalation

An acute inhalation toxicity study was conducted in accordance with GLP and as per OECD 403 guideline. Groups of male and female CD (BR) rats were exposed to an aerosol of Kathon 886 via nose only at concentrations of 0.19, 0.32, 0.50, 1.26, 2.24, and 3.02 mg test material/L. Signs of respiratory irritation, including gasping, rales, hyperpnea, dyspnoea and vocalization were seen in some animals in all groups immediately post-exposure. The number of animals showing these signs and the severity of the respiratory irritation correlated with the concentration of the test material to which the animals were exposed in the report. The signs of respiratory irritation disappeared in all surviving animals from two to twelve days. Under the conditions of the study, a combined male and female LC_{50} value of 0.33 mg a.i per litre of air was determined (ECHA). [KI Score = 1].

Dermal

An acute dermal toxicity study was conducted before implementation of GLP protocols. Male albino rabbits were exposed dermally to Kathon 886 at 313, 625, 1250 and 2500 mg/kg under occlusive conditions. Skin irritation consisted of severe erythema and oedema followed by eschar formation. LD_{50} was determined to be 660 mg Kathon^{TM} 886/kg bw with 95% confidence limits of 370 and 1210 mg/kg. This corresponds to LD_{50} = 87.12 mg/kg a.i. (pure CMIT/MIT). (ECHA). [KI Score = 2].

D. Irritation

Skin

Two OECD 404 guideline compliant studies are provided indicating CMIT/MIT is corrosive to the skin.

A skin irritation/corrosion study was conducted according to OECD Guideline 404. As part of the study, white rabbits under semi occlusive conditions were exposed to the test substance for 1 or 4 hours. Severe oedema (score = 4) was observed in five animals, and one animal had a moderate oedema (score = 3) one hour after patch removal. This oedema was raised more than 2 mm and extended beyond the area of exposure. By day 3, this irritation reversed such that only 3 animals had a slight oedema. There was total recovery after 8 days. One animal had a well-defined erythema with slight eschar formations. A reversal was observed after 72 h with total recovery after 11 days. Under the conditions of the study, the material was classified as corrosive to skin following a 1-hour or 4-hour exposure period, but the effects were fully reversible [KI. Score = 2](ECHA).

A second skin irritation/corrosion study was also conducted according to the OECD Guideline 404. In the study, the irritating or corrosive potential of a 13.9 % aqueous solution of a 3:1 mixture of 5 -chloro-2 -methyl-2H-isothiazol-3 -one and 2 -methyl-2H-isothiazol-3 -one in water (named ACTICIDE 14 in this study report) was evaluated. One male New Zealand White rabbit was exposed to 0.5 ml of the test item for 4 hours. The test substance was removed, and the treated skin was observed for abnormalities, severity and potential reversibility. Findings were scored according to the system proposed by Draize. Severe erythema and oedema were observed shortly after treatment. While erythema was not reversible, oedema was not observed after day 7. (ECHA). [KI. Score = 1].

Eye

An *in vivo* eye irritation study indicated that Kathon™ 886 produces severe lesion to the eyes of New Zealand White rabbits which were irreversible. Kathon™ 886 should be considered as corrosive to the eyes of rabbits. (ECHA). [Kl. Score = 2].

E. Sensitisation

A local lymph node assay (LLNA) study in CBA/J mice was conducted in compliance with the proposed Local Lymph Node Assay protocol prepared by the Interagency Coordinating Committee for Validation of Alternative Methods (ICCVAM) Immunotoxicology Working Group (IWG): National Institutes of Health Publication N°: 99-449, Appendix J, 1999. Groups of mice were exposed to Kathon 886 at nominal concentrations of 0, 30, 50, 70, 90, 360, 1000 ppm a.i. in 4:1 acetone/olive oil and evaluated for skin sensitisation reactions. All concentrations evaluated produced a stimulation index greater than or equal to 3. The results of the study indicate that the CMIT/MIT exhibits a statistically significant, generally dose-related potential to induce contact hypersensitivity in mice. [Kl Score=1] (ECHA).

The potential of a 14% aqueous solution of 3 parts 5 -chloro-2 -methyl-2H-isothiazol-3 -one and 1 part 2 -methyl-2H-isothiazol-3 -one (ACTICIDE 14) to cause skin sensitisation was investigated in a Guinea Pig Maximisation Test (OECD guideline 406). Male and female Dunkin-Hartley guinea pigs were treated with the test substance by intradermal injection (mixed with Freud`s complete Adjuvant) and 6 days later by cutaneous application under occlusive dressing for 48 hours (induction). Two weeks later, animals were treated with the test substance by cutaneous application for 24 hours at a site different from the first application sites (challenge). After another week, animals of the low-dose group were treated with the test substance by dermal application at a lower dose (rechallenge). Slight to moderate erythema were observed after intradermal induction, and local irritation after cutaneous induction. At challenge, all substance-induced animals and half of the control animals presented signs of severe skin reactions. Therefore, animals of the low dose group and a new control group were re-challenged one week later with 100 -1000 -fold less substance by dermal route. In the rechallenge, only animals treated with the high concentration (0.025% ACTICIDE 14) responded positive (4 of ten animals), while animals treated with factor ten lower amounts and the control animals showed no signs of toxicity (ECHA) [Kl Score = 1].

F. Repeated Dose Toxicity

Oral

CMIT/MIT was tested in several oral repeated dose toxicity studies in rabbits, rats and dogs for 4 weeks and 3 months.

The toxic potential of a 13.9 % aqueous solution of a 3:1 mixture of 5 -chloro-2 -methyl-2H-isothiazol-3 -one and 2 -methyl-2H-isothiazol-3 -one in water (ACTICIDE 14) was evaluated in a 90-day repeated dose dietary toxicity study in non-rodents according to OECD guideline 409. Male and female beagle dogs were treated with the test item by dietary administration over a period of 90 days. The animals were observed for clinical signs, alterations in body weight and food consumption throughout the study period. At selected timepoints before and during the study, blood was collected for haematology and clinical chemistry. At the end of the treatment period, the animals were sacrificed and subjected to detailed macroscopic and microscopic pathological examination.

A dose-dependent loss of bodyweight and reduction in food consumption was observed, while all other observed alterations/abnormalities could not be related to treatment and were considered incidental. The applied doses could analytically not be verified; thus, the exposure doses of the test animals were calculated from the worst-case recovered values.

The observed effects on body weight gain were only seen at the two highest doses and were probably the result of the poor palatability of the diet rather than any toxic properties of ACTICIDE 14. Thus, it was concluded that there was no evidence of organ or systemic toxicity when ACTICIDE 14 up to 555 ppm (nominal concentration 750 ppm), which is equivalent to 22 mg ai/kg body weight/day (30 mg ai/kg body weight/day) to the laboratory beagle for up to 13 weeks. A No Observed Adverse Effect Level (NOAEL) of 22 mg/kg bw/day was established. (ECHA). [Kl. Score = 1].

In a repeated dose 90-day oral toxicity study in rodents, no systemic toxic effects and no adverse effects on the histopathology of any tissues/organs distant from the site of dosing (drinking water) was observed. A NOAEL of 250 ppm ai in water (16.3 mg a.i./kg/day in males and 24.7 mg a.i./kg/day in females) was established. (ECHA). [Kl. Score = 1].

In another oral toxicity study, administration of Kathon™ biocide to male and female rats in the drinking water for 24 months at concentrations up to and including 300 ppm a.i. showed no effects on the type or incidence of neoplasms in any group. No systemic effects were observed. Treatment-related morphologic changes were observed only in the stomach of both sexes in mid and high dose groups. Gastric irritation was the primary effect observed. No adverse effects on the histopathology of any tissues/organs distant from the site of dosing. Based on the study findings, a NOAEL of 300 ppm was established (17.2 mg a.i./kg bw/day in males and 25.7 mg a.i./kg bw/day in females). (ECHA). [Kl. Score = 1].

Inhalation

In a 90-day sub-chronic inhalation study, conducted in accordance with GLP and as per OECD 413 guideline, groups of male and female CD (SD) BR rats were exposed to an aerosol of Kathon 886 via nose only at concentrations of 0.34, 1.15 and 2.64 mg/m^3. There were no systemic effects in this study. Rats at the highest dose (2.64 mg/m^3) exhibited very mild, low grade respiratory irritation. No adverse effects on the histopathology of any tissues/organs distant from the site of dosing. A NOAEL of 0.34 mg/m^3 was established. (ECHA). [Kl. Score = 1].

Dermal

The toxic potential of a 13.9 % aqueous solution of a 3:1 mixture of 5 -chloro-2 -methyl-2H-isothiazol-3 -one and 2 -methyl-2H-isothiazol-3 -one in water (ACTICID 14) was evaluated in a 90-day repeated dose dermal toxicity study in rats according to EPA OPP 82 -3 guideline. Male and female Sprague-Dawley rats were treated with the test item on exposed skin daily for 6 hours over a period of 90 days. The test article was kept in place and prevented from oral ingestion by means of a semi-occlusive dressing for exposure and remainders of the test item were then removed with water. The animals were observed for mortality, clinical signs, body weight gain and food consumption. At the end of the treatment period, blood and urine were collected for haematology and clinical chemistry. The animals were subjected to detailed macroscopic and microscopic pathological evaluation, including scoring of observed skin abnormalities.

Mortalities observed in two control animals and one high-dose male are considered to be incidental and not related to the application of the test material. Treatment with ACTICIDE 14, applied dermally to intact skin, produced skin reactions (slight to moderate erythema and desquamation, slight oedema and atonia as well as eschar formation) with dose-dependent grades of severity. Females appeared to be more sensitive than males. There were no other effects at the end of the treatment period that could be attributed to the test substance. A NOAEL for systemic toxicity was established as 2.625 mg a.i. /kg bw/day. A NOAEL for local irritation was established as 0.105 mg a.i./kg bw/day in males. No NOAEL for local irritation was established for female rats. (ECHA). [Kl. Score = 1].

A 90-day subchronic dermal toxicity study was conducted in White New Zealand Rabbits. Doses of 100, 200 and 400 ppm of Kathon 886 were applied 5 days per week for a minimum total of 65 applications. Slight to severe erythema and slight oedema were noted in a dose-related manner (0.1 mg/kg/day and above). There were no systemic effects in this study. No adverse effects on the histopathology of any tissues/organs distant from the site of dosing. A NOAEL of 400 ppm a.i. based on skin irritation (0.4 mg/kg bw/day) was established. (ECHA). [Kl. Score = 2].

G. Genotoxicity

In Vitro Studies

Several *in vitro* studies of genotoxicity were performed with CMIT/MIT. Positive results were observed in three Ames assays and in three tests in mammalian cells (one chromosomal aberration test and two mouse lymphoma assays), with or without S9 activation. (ECHA).[Kl. Score =1 or Kl. Score =2]. In contrast, CMIT/MIT was not mutagenic in primary culture of rat hepatocytes [Unscheduled DNA Synthesis (UDS)] and in a mouse cell transformation test (ECHA) [Kl. Score =1 or Kl. Score = 2].

In Vivo Studies

CMIT/MIT was tested in one *in vivo* chromosomal aberration assay in mice (bone marrow) and one micronucleus test in mice (bone marrow). Negative results were observed in these *in viv*o studies. (ECHA). [Kl. Score = 1].

In the absence of genotoxicity, additional tests were carried out in tissue other than bone marrow. Two UDS assays in rats confirmed the absence of genotoxicity of CMIT/MIT when tested in vivo. (ECHA). [Kl. Score = 1].

H. Carcinogenicity

Oral

An OECD Guideline 453 (Combined Chronic Toxicity / Carcinogenicity Studies) on male and female Crl:CD BR rats was performed. Administration of the substance to male and female rats in the drinking water for 24 months at concentrations up to and including 300 ppm a.i. (17.2 mg a.i./kg of body weight/day in males and 25.7 mg a.i./kg of body weight/day in females) showed no effects on the type or incidence of neoplasms in any group.

No treatment-related signs of toxicity were seen at 30 ppm a.i.(2.0 mg a.i./kg of body weight/day in males and 3.1 mg a.i./kg of body weight/day in females), the No-Observed Effect Level (NOEL) in this study [Kl Score = 1](ECHA).

Dermal

The mouse skin painting carcinogenicity study was initiated prior to the adoption of carcinogenicity study guidelines. However, the principles of OECD Guideline 451, in general, were followed. Kathon™CG, when applied dermally to the closely clipped skin on the backs of male CD-1 mice at a concentration of 400 ppm active substance and at a dose of 25 microliters (µL) 3 times per week for 30 months, showed no local or systemic tumorigenic potential. No adverse effects were seen on the histopathology of any tissues/organs distant from the site of dosing. (ECHA). [Kl. Score = 2].

I. Reproductive/Developmental Toxicity

An OECD Guideline 416 (Two-Generation Reproduction Toxicity Study) was performed on male and female Sprague-Dawley rats exposed to Kathon™ 886F biocide in the drinking water. No treatment-related deaths or clinical signs of systemic toxicity in either sex up to and including 300 ppm. No treatment-related effects on body weights up to and including 100 ppm in males and females and 300 ppm in females. In 300 ppm males, a treatment-related decrease (5 %) in mean body weight was seen during weeks 1 through 6 of treatment. No treatment-related effects on premating feed consumption in either sex at any dose level. Treatment-related and concentration-dependent decreases in water consumption were noted in all-Kathon™ exposed groups in both the P1 and P2 animals through most of the premating, gestation and lactation periods. No treatment-related effects on any endpoint of mating or fertility in either generation at any dose level. No treatment related effects on sperm motility, testicular sperm count or caudal epididymal reserves of P1 and P2 males at any dose level. Treatment-related microscopic findings were limited to the stomach of male and female parental animals at 100 and/or 300 ppm. These changes included an increased incidence of focal superficial erosions of the glandular mucosa, oedema and inflammation of the submucosa of the glandular and nonglandular areas, and hyperplasia and hyperkeratosis of the nonglandular stomach. Based on these findings, a NOAEL for parental animal toxicity of 30 ppm (2.8-4.4 mg/kg/day in the P1 animals and 4.3-5.5 mg/kg/day in the P2 animals) was established. The reproductive and developmental NOEL was 300 ppm (22.7-28.0 mg/kg/day in the P1 animals and 35.7-39.1 mg/kg/day in the P2 animals).(ECHA). [Kl. score = 1]

An OECD Guideline 415 (One-Generation Reproduction Toxicity Study) was performed on male and female Sprague-Dawley rats exposed to Kathon™ 886F biocide in the drinking water. Kathon™ 886 NAR has no adverse effects on the reproductive capability of male or female rats and no effect on foetal health or survival to day 21 at concentrations up to and including 225 ppm in the drinking water. These values correspond to a dose level of 16.3 mg/kg/day in males and 24.7 mg/kg/day in females. (ECHA). [Kl. score = 1]

The potential of a 14% aqueous solution of 3 parts 5 -chloro- 2 -methyl-2H-isothiazol-3 -one (CMIT) and 1 part 2 -methyl-2H-isothiazol-3 -one (MIT) (ACTICIDE 14) to induce teratogenic effects in rats was evaluated in a Prenatal Developmental Toxicity Study (according to guideline EPA OPP 83 -3). Pregnant female Sprague-Dawley rats were treated with the test substance by oral gavage during the period of organogenesis (days 6 -15 post coitum). Animals were observed for mortality, signs of toxicity, food consumption and body weight gain during the treatment and a post-exposure period of 5 days. At day 20 of gestation, animals were sacrificed and examined for macroscopic pathological

abnormalities. Uterine contents were examined for signs abnormal pregnancy courses, and foetuses were examined for external, visceral and skeletal abnormalities.

Treatment with the test article resulted in maternal toxicity with clearly distinguished dose-dependent grades of severity (clinical signs, moderately reduced body weight gain, slightly reduced food consumption). In spite of the observed adverse maternal effects, treatment with the test article did not have any influence on the embryonic and foetal development, as there was no embryotoxicity and no teratogenicity detected in any of the dose groups. (ECHA). [Kl. Score = 1].

An equivalent OECD Guideline 414 (Prenatal Developmental Toxicity Study) was performed on male and female Sprague-Dawley rats exposed to Kathon™ 886F biocide administered orally by gavage. No developmental effects were observed. Kathon™ 886 is non-teratogenic to the rat when administered at dosages of 100 mg/kg/day (15 mg ai/kg bw/day) during organogenesis. (ECHA). [Kl. Score = 1].

An OECD Guideline 414 (Prenatal Developmental Toxicity Study) was performed on pregnant New Zealand white rabbits exposed to Kathon™ 886 MW Biocide administered orally by gavage. No treatment-related deaths were observed at doses of 0, 0.5, 2 or 8 mg a.i./kg. At 20 mg a.i./kg, 16/16 animals were sacrificed moribund on or before day 15 GD. Based on the results of this study, a maternal NOEL of 2 mg a.i./kg and an embryo-foetal NOEL of 8 mg a.i./kg was established. No treatment related increases were detected in the type or incidence of external, visceral or skeletal malformations, variations due to retarded development or in the total of these two categories combined. (ECHA). [Kl. Score = 1].

J. Derivation of Toxicological Reference and Drinking Water Guidance Values

Toxicological reference values were derived for the mixture of CMIT and MIT using methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011) as shown below.

Non-Cancer

A two-year drinking water study has been conducted in rats with a CMIT/MIT mixture (14.2% a.i.; 10.13% CMI/3.85% MI). No systemic toxicity was observed at doses up to 300 ppm a.i., although there was gastric irritation of the stomach at doses of 100 and 300 ppm a.i. The NOAEL for systemic toxicity in this study is 300 ppm (corresponding to 17.2 mg a.i./kg bw/day in males and 25.7 mg a.i./kg bw/day in females). The lowest NOAEL from this study (17 mg/kg bw/day) will be used to derive the oral reference dose.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:
UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 1
UF_D (database uncertainty) = 1

Oral RfD = 17.2/(10 x 10 x 1 x 1 x 1) = 17.2/100 = 0.17 mg/kg-day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD:

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:
Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)

Drinking water guidance value = (0.17 x 70 x 0.1)/2 = 0.60 mg/L

Cancer

The mixture of CMIT and MIT was not carcinogenic to rats in a two-year dietary study. Thus, a cancer reference value was not derived.

K. Human Health Hazard Assessment of Physico-Chemical Properties

CMIT/MIT does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

7 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

The mixture of CMIT and MIT exhibits significant acute and chronic aquatic toxicity. The mixture is also toxic to sediment dwelling organisms but less toxic to terrestrial receptors.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on the mixture of CMIT and MIT.

Table 3 Acute Aquatic Toxicity Studies on CMIT/MIT

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Rainbow Trout (*Oncorhynchus mykiss*)	96-hour LC_{50}	0.19	1	ECHA

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Water Flea *(Daphnia magna)*	48-hour EC_{50}	0.16	1	ECHA
Skeletonema costatum	72-hour EC_{50}	0.0063	1	ECHA
Selenastrum capricornutum	72-hour EC_{50}	0.0273	1	ECHA

Chronic Studies for MIT/CMIT

Table 4 lists the results of chronic aquatic toxicity studies conducted on the mixture of CMIT and MIT.

Table 4 Chronic Aquatic Toxicity Studies on CMIT/MIT

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Rainbow Trout (*Oncorhynchus mykiss*)	38-day NOEC	0.02	1	ECHA
Water Flea *(Daphnia magna)*	21-day NOEC	0.10	1	ECHA
Skeletonema costatum	72-hour NOEC	0.0014	1	ECHA

C. Sediment Toxicity

The 28-day no observed effect concentration (NOEC) for Oligochaete (*Lumbriculus variegatus*) is 0.27 mg/kg dry weight based on survival (ECHA) [Kl. score = 2].

The 28-day no observed effect concentration (NOEC) for the midge *Chironomus riparius* is 3.65 mg/kg dry weight based on survival (ECHA) [Kl. score = 1].

D. Terrestrial Toxicity

An OECD Guideline 208 (Terrestrial Plants Test: Seedling Emergence and Seedling Growth Test) was conducted on CMIT/MIT. No apparent signs of treatment-related phytotoxicity were observed to any of the three species tested (Trifolium pratense, Oryza sativa and Brassica napus). A 21-day NOEC of 1000 mg/kg soil dw, the highest concentration tested, was derived from the study results (ECHA). [Kl. Score = 1].

Effects on soil microflora carbon respiration transformation (OECD Guideline 217) and effects on nitrogen transformation activity of soil microorganisms (OECD Guideline 216) was also studied. Greater than 50 % respiration rate inhibition was demonstrated at test concentrations of 50, 100 and 500 mg CMIT/MIT per kg dry weight soil. A 28-day NOEC value of 1 mg/kg soil dw (based on respiration rate) was determined. (ECHA) [Kl. Score = 1]. CMIT/MIT inhibited the nitrogen transformation process in active soil within the range of concentrations evaluated. A 28-day NOEC value of 10 mg/kg soil dw (based on nitrate formation rate) was determined. (ECHA) [Kl. Score = 1]..

An acute toxicity test with the earthworm *Eisenio fetido* under static conditions in artificial soil was performed with ACTICIDE® 14 (14.3% aqueous solution of CIT and MIT (3:1)) according to OECD Guideline 207 and ISO 11 268-1. Five concentrations were tested ranging from 100 to 1000 mg

ACTICIDE® 14/kg dry soil (nominal). ACTICIDE® 14 caused clear sub-lethal but only moderate lethal effects in earthworms. A NOEC of 100 mg/kg dry soil (=14.3 mg a.i./kg dry soil) due to reduced mobility of the worms and a 14-day LC_{50} of >1000 mg/kg dry soil (>143 mg a.i./kg dry soil) was determined. (ECHA). [Kl. Score = 1].

Results from toxicity studies on mallard duck (*Anas platyrhynchos*) and bobwhite quail (*Colinus virginianus*) demonstrate that C(M)IT/MIT exhibits slight to moderate toxicity to birds. The 21-day oral LD_{50} for bobwhite quail is 64.5 mg/kg bw. The short-term (8-day) dietary LC_{50} for mallard duck is 945 mg/kg and bobwhite quail is 3532 mg/kg (ECHA). [Kl. Score = 1].

E. Calculation of PNEC

The PNEC calculations for CMIT/MIT follow the methodology discussed in DEWHA (2009).

$PNEC_{water}$

Experimental results are available for three trophic levels. Acute EC_{50} values are available for fish (0.19 mg/L), invertebrates (0.16 mg/L) and algae (0.0063 mg/L). Results from chronic studies are also available for all three trophic levels, with the lowest NOEC value being 0.0014 mg/L for algae. On the basis that the data consists of short-term and long-term results from three trophic levels, an assessment factor of 10 has been applied to the lowest reported NOEC of 0.0014 mg/L for algae. The $PNEC_{water}$ for CMIT/MIT is 0.00014 mg/L.

$PNEC_{sediment}$

Experimental results are available for two sediment dwelling organisms. The lowest NOEC was observed in a chronic sediment-spiked test with Oligochaete, the 28-day NOEC was 0.27 mg/kg dw. Using an assessment factor of 50, the $PNEC_{sediment}$ was determined to 0.0054 mg/kg dw.

$PNEC_{soil}$

Experimental results are available for three trophic levels. Acute $E(L)C_{50}$ values are available for earthworms (>1000 mg/kg dw). Long-term studies have also been conducted on plants and soil microorganisms. On the basis that the data consists of acute tests from one trophic level and long-term tests from two trophic levels, an assessment factor of 50 has been applied to the lowest reported NOEC value of 1 mg/kg dw for soil microorganisms. The $PNEC_{soil}$ is 0.02 mg/kg dw.

8 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

The biodegradability of the mixture of CMIT and MIT could not be established. Biodegradation studies on CMIT and MIT separately have been conducted. An OECD Guideline 301 B (Ready Biodegradability: CO2 Evolution Test) was performed. 50% of the MIT biodegraded within 29 days. While the substance does not qualify as readily biodegradable, the data suggest it is ultimately biodegradable. The same test with CMIT showed up to 62% of the test substance biodegraded within the same time frame of 29 days. [KI Score=1](ECHA). The rate of biodegradation in these tests does not satisfy the OECD criterion for readily biodegradability (60% in a 10-day window), but the results do show that these chemicals are biodegradable at more realistic environmental exposure concentrations. Thus, CMIT/MIT do not meet the criteria for persistence.

Bioaccumulation studies are not available for the CMIT/MIT mixture. Individually, the experimental BCF for CMIT is 67-114 in bluefish sunfish, and the BCF for MIT was determined to be 2.3. Thus, CMIT/MIT do not meet the criteria for bioaccumulation.

The chronic toxicity data on the mixture of CMIT and MIT has a NOEC < 0.1 mg/L.. The lowest acute LC_{50} value for the mixture is < 1 mg/L. Therefore, CMIT/MIT meets the criteria for toxicity.

The overall conclusion is that the mixture of CMIT/MIT is not a PBT substance.

B. Other Characteristics of Concern

Only tier 3 chemicals which trigger persistence and bioaccumulative thresholds are considered to be chemicals with a potential for cumulative impacts. As noted in the prior section, both CMIT/MIT mixture do not meet the criteria for persistence or bioaccumulation.

No other characteristics of concern were identified for the mixture of CMIT and MIT.

9 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
Mixture of 5-chloro-2-methyl-2h-isothiazolol-3-one (CMIT) and 2-methyl-2h-isothiazol-3-one (MIT)	55965-84-9	Not a PBT	No	No	No	No	No	Yes	3	3	3

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 3 - Quantitative Risk Assessment: Complete PBT, qualitative and quantitative assessment of risk.

Notes:

CAS No. = chemical abstracts service number

COC = chemical of concern

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

10 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
µg/L	micrograms per litre
a.i.	active ingredient
ADWG	Australian Drinking Water Guidelines
AICS	Australian Inventory of Chemical Substances
bw	body weight
CAS RN	Chemical Abstract Services Registry Number
CFR	Code of Federal Regulations
COC	chemical of concern
DoEE	Department of the Environment and Energy
EC_{50}	median effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
GLP	Good Laboratory Practice
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg/m^3	kilogram per cubic metre
KI	Klimisch scoring system
K_{ow}	n-octanol/water partition coefficient
kPa	kilopascal
LC_{50}	lethal concentration 50%
LD_{50}	lethal dose 50%
LLNA	local lymph node assay

LOAEL	lowest observed adverse effect concentration
LOEC	lowest observed effect concentration
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
NOEL	no observed effect level
OECD	Organisation for Economic Co-operation and Development
Pa	Pascal
PBT	Persistent, Bioaccumulative and Toxic
PNEC	Predicted No Effect Concentration
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RfD	reference dose
SGG	Synthetic Greenhouse Gases
UDS	Unscheduled DNA Synthesis
USEPA	United States Environmental Protection Agency

ACRYLAMIDE, SODIUM ACRYLATE POLYMER (CAS RN 25987-30-8)
2-PROPENOIC ACID, POTASSIUM SALT, POLYMER WITH 2-PROPENAMIDE (CAS RN 31212-13-2)
ACRYLATE TERPOLYMER (CAS RN 903573-39-7)[1]
SILICONE BASED EMULSION NEUTRALISED POLYACRYLIC BASED STABILIZER (NO CAS RN)
2-PROPENOIC ACID, SODIUM SALT (1:1), POLYMER WITH 2-PROPENAMIDE AND SODIUM 2-METHYL-2-[(1-OXO-2-PROPEN-1-YL)AMINO]-1-PROPANESULFONATE (1:1) (CAS RN 53845-65-1)
2-PROPENOIC ACID, SODIUM SALT (1:1) (CAS RN 107097-75-6)
PROPANESULFONIC ACID, 2-METHYL-2-[(1-OXO-2-PROPENYL)AMINO]-, MONOSODIUM SALT, POLYMER WITH N,N-DIMETHYL-2-PROPENAMIDE (CAS RN 92815-96-8)

This group contains a sodium salt of a polymer consisting of acrylic acid, methacrylic acid or one of their simple esters and six similar polymers. They are expected to have similar environmental concerns and have consequently been assessed as a group. Information provided in this dossier is based on acrylamide/sodium acrylate copolymer (CAS RN 25085-02-3).

This dossier on acrylamide/sodium acrylate copolymer and similar polymers presents the most critical studies pertinent to the risk assessment of these polymers in their use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Acrylamide/sodium acrylate copolymer, acrylamide, sodium acrylate polymer and 2-propenoic acid, potassium salt, polymer with 2-propenamide are polymers of low concern. Therefore, these polymers and the other similar polymer in this group are classified as **tier 1** chemicals and require a hazard assessment only.

1. BACKGROUND

Acrylamide/sodium acrylate copolymer is a sodium salt of a polymer consisting of acrylic acid, methacrylic acid or one of their simple esters. Acrylates are a family of polymers which are a type of vinyl polymer. Synthetic chemicals used in the manufacture of plastics, paint formulations and other products. Acrylate copolymer is a general term for copolymers of two or more monomers consisting of acrylic acid, methacrylic acid or one of their simple esters.

Based largely on its high molecular weight, acrylamide/sodium acrylate copolymer are not expected to bioaccumulate or bioconcentrate. It is of low toxicity to environmental receptors and is not expected to degrade substantially under environmental conditions.

2. CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): 2-Propenoic acid, sodium salt, polymer with 2-propenamide

CAS RN: 25085-02-3

Molecular formula: $(C_3H_5NO.C_3H_4O_2.NA)_x$-

[1] CAS name: 2-Propenoic acid, polymer with sodium 2-hydroxy-3-(2-propen-1-yloxy)-1-propanesulfonate (1:1) and alpha-sulfo-omega-(2-propen-1-yloxy)poly(oxy-1,2-ethanediyl) ammonium salt (1:1), sodium salt

Molecular weight: No information is available. Based on the type and intended use of the copolymer, the molecular weight would likely range from 100,000 to >3,000,000 g/mol (Hamilton *et al.*, 1997).

Synonyms: Acrylamide/sodium acrylate copolymer; 2-propenamide, polymer with 2-propenoic acid, sodium salt; 2-propenoic acid, sodium salt, polymer with 2-propenamide; 2-Propenamide-sodium 2 propenoate copolymer; sodium acrylate acrylamide polymer; sodium acrylate-acrylamide copolymer

3. PHYSICO-CHEMICAL PROPERTIES

No information is available.

4. DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 1). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for acrylamide/sodium acrylate copolymer and these similar polymers.

NICNAS has assessed acrylamide/sodium acrylate copolymer (CAS RN 25085-02-3), acrylamide, sodium acrylate polymer (CAS RN 25987-30-8) and 2-propenoic acid, potassium salt, polymer with 2-propenamide (CAS RN 31212-13-2) in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and considers each a polymer of low concern.[2]

Table 1 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5. ENVIRONMENTAL FATE SUMMARY

No studies are available. The acrylamide/sodium acrylate copolymer is not expected to be readily biodegradable. The physico-chemical properties of the copolymer would preclude it from undergoing significant biodegradation (Guiney *et al.*, 1997). Biodegradation is limited due to the very high molecular weight and the low water solubility of the copolymer. The copolymer will likely bind tightly to organic matter found within soils and sediments (Guiney *et al.*, 1997). The copolymer is not expected to bioaccumulate because of its poor water solubility and high molecular weight.

[2] https://www.industrialchemicals.gov.au/help-and-guides/polymer-low-concern-plc-criteria

6. ENVIRONMENTAL EFFECTS SUMMARY

No studies are available. Acrylamide/sodium acrylate copolymer is expected to be a low concern for toxicity to aquatic organisms (Guiney *et al.*, 1997). Due to its poor solubility and high molecular weight, it is not expected to be bioavailable. It does not contain any reactive functional groups (*i.e.*, cationic groups).

7. CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU Reach Criteria methodology (IChEMS, 2022; ECHA, 2023).

Acrylamide/sodium acrylate copolymer is not readily biodegradable; thus, it meets the screening criteria for persistence.

Acrylamide/sodium acrylate copolymer is expected to have a very high molecular weight and poor water solubility. It is not expected to be bioavailable. Thus, this copolymer does not meet the criteria for bioaccumulation.

There are no aquatic toxicity studies on acrylamide/sodium acrylate copolymer. It is expected to have low concern for aquatic toxicity because of its very high molecular weight and poor water solubility. Thus, the copolymer does not meet the criteria for toxicity.

The overall conclusion is that acrylamide/sodium acrylate copolymer is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for acrylamide/sodium acrylate copolymer.

8. SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
Acrylamide/sodium acrylate copolymer	25085-02-3	Not a PBT	No	Yes	Yes	No	No	No	1	1	1
2-Propenoic acid, potassium salt, polymer with 2-propenamide	31212-13-2	Not a PBT	No	Yes	Yes	No	No	No	1	1	1
Acrylamide, sodium acrylate polymer	25987-30-8	Not a PBT	No	Yes	Yes	No	No	No	1	1	1
Silicone based emulsion neutralised polyacrylic based stabiliser	NS	Not a PBT	No	No	Yes	No	No	No	1	1	1
Acrylate Terpolymer	903573-39-7	Not a PBT	No	No	Yes	No	No	No	1	1	1
2-Propenoic acid, sodium salt (1:1), polymer with 2-propenamide and sodium 2-methyl-2-[(1-oxo-2-propen-1-yl)amino]-1-propanesulfonate (1:1)	53845-65-1	Not a PBT	No	No	Yes	No	No	No	1	1	1
Propanesulfonic acid, 2-methyl-2-[(1-oxo-2-propenyl)amino]-, monosodium salt, polymer with N,N-dimethyl-2-propenamide	92815-96-8	Not a PBT	No	No	Yes	No	No	No	1	1	1
2-Propenoic acid, sodium salt (1:1)	107097-75-6	Not a PBT	No	No	Yes	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.
2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).
3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9. REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy
ECHA	European Chemicals Agency
EU	European Union
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
KI	Klimisch scoring system
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases

CRYSTALLINE SILICA, QUARTZ (CAS RN 14808-60-7)
CRYSTALLINE SILICA, CRISTOBALITE (CAS RN 14464-46-1)
CRYSTALLINE SILICA, TRIDYMITE (CAS RN 15468-32-3)
NON-CRYSTALLINE SILICA (IMPURITY) (CAS RN 7631-86-9)
DIATOMACEOUS EARTH (CAS RN 61790-53-2)
DIATOMACEOUS EARTH, CALCINED (CAS RN 91053-39-3)
MICA (CAS RN 12001-26-2)

This dossier on crystalline silica, quartz, cristobalite and tridymite; non-crystalline silica (impurity); diatomaceous earth; diatomaceous earth, calcined; and mica presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

For the purpose of this dossier, crystalline silica, quartz (CAS RN 14808-60-7) has been reviewed as representative of crystalline silica cristobalite and tridymite, and non-crystalline silica (impurity). Crystalline silica, quartz is also considered representative of diatomaceous earth, diatomaceous earth, calcined and mica, as they all consist mainly of silicon dioxide.

Based on an assessment of environmental hazards, NICNAS identified members of this group (crystalline silica, quartz, cristobalite and tridymite and diatomaceous earth, calcined) as a chemical of low concern to the environment (DoEE, 2017). Chemicals of low concern are unlikely to have adverse environmental effects if they are released to the environment from coal seam gas operations.

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): dioxosilane

CAS RN: 14808-60-7

Molecular formula: SiO_2

Molecular weight: 60.084 g/mol

Synonyms: Cristobalite, Dioxide, Silicon

SMILES: O=[Si]=O

II. PHYSICO-CHEMICAL PROPERTIES

Silica is an off-white granule that occurs naturally in various crystalline and amorphous or other non-crystalline forms. Crystalline silica is characterised by silicon dioxide (SiO_2) molecules oriented in fixed, periodic patterns to form stable crystals. The primary crystalline form of silica is quartz. Other crystalline forms of silica include cristobalite, tripoli and tridymite. Particle size is a key determinate of silica toxicity, since toxicity is restricted to particles that are small enough to be deposited into the target regions of the respiratory tract (OECD, 2011).

See attached OECD-SIDS Initial Targeted Assessment Profile on Quartz and Cristobalite, SIAM 32, 19-21 April 2011.

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Crystalline silica is characterised by silicon dioxide (SiO_2) molecules oriented in fixed, periodic patterns to form stable crystals. The primary crystalline form of silica is quartz. It is a stable solid under typical environmental conditions. It will not biodegrade, bioaccumulate, nor will it sorb to sediments or soils.

B. Biodegradation

No data are available. Based on the crystalline form of the substance, it is not expected to biodegrade.

C. Environmental Distribution

No experimental data are available for crystalline silica. As a stable inorganic solid, it is not soluble in water, and it will not sorb to soils or sediment.

D. Bioaccumulation

There are no bioaccumulation studies on crystalline silica.

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Human exposure to crystalline silica via inhalation can lead to silicosis, lung cancer and pulmonary tuberculosis (WHO, 2000).

B. Acute Toxicity

No adequate acute oral, dermal or inhalation exposure studies are available for quartz, cristobalite or tridymite.

Most acute toxicity studies for quartz or cristobalite were conducted using intratracheal instillation. Intratracheal instillation is the introduction of the substance directly to the trachea and is used to test respiratory toxicity of a substance.

Single intratracheal instillation of quartz caused inflammatory effects and formation of discrete silicotic nodules in rats, mice and hamsters (IARC, 2012; WHO, 2000). Other effects like oxidative stress, cellular proliferation and increases in water, protein and phospholipid content of rat lungs, apoptosis (programmed cell death) and lung cancer were also noted.

In an acute dose study, rats were dosed once with 0, 0.75, 1.5, 3.0, 6.0 or 12 mg/kg bw/day quartz by intratracheal instillation (Seiler et al., 2001). The lowest observed adverse effect level (LOAEL) of 0.75 mg/kg bw/day was derived from these studies.

Two other similar studies of single intratracheal instillation of quartz reported higher LOAELs in rats (3 and 40 mg/kg bw/day) based on inflammation and fibrosis (Saffiotti et al., 1996).

C. Irritation

No data available.

D. Sensitisation

No data available.

E. Repeated Dose Toxicity

Oral

No data available.

Inhalation

Repeated inhalation exposure of crystalline is known to cause adverse effects (IARC, 2012). Silicosis has been identified as the main non-cancer effect of silica exposure, although available epidemiologic data as well as animal data provide evidence for several other effects associated with silica exposure, such as silicotuberculosis, enlargement of the heart (cor pulmonale), interference with the body's immune system and damage to the kidneys (Health Canada, 2013).

Dermal

No data available.

F. Genotoxicity

No data available.

G. Carcinogenicity

Oral

No data available.

Inhalation

The International Agency for Research on Cancer (IARC) has classified crystalline silica as a Group 1 carcinogen, as there was sufficient evidence for carcinogenicity in experimental animals and sufficient evidence for carcinogenicity of inhaled crystalline silica from occupational sources (IARC, 1997; IARC, 2012).

H. Reproductive Toxicity

No data available.

I. Developmental Toxicity

No data available.

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicity information on crystalline silica is inadequate and/or unreliable for deriving toxicological reference and drinking water guidance values for this substance.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Crystalline silica does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Although no data are available, crystalline silica is expected to exhibit low acute toxicity to aquatic organisms.

B. Aquatic Toxicity

No aquatic toxicity data were available.

C. Terrestrial Toxicity

No terrestrial toxicity data were available.

D. Calculation of PNEC

No PNEC values were calculated.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Crystalline silica is an inorganic mineral. Thus, biodegradation is not applicable to this substance. For the purposes of this PBT assessment, the persistent criteria are not considered applicable to crystalline silica.

As an inorganic complex it is not expected to bioaccumulate. Thus, crystalline silica does not meet the screening criteria for bioaccumulation.

Crystalline silica is not expected to cause adverse effects in environmental receptors. Thus, this substance does not meet the screening criteria for toxicity.

Therefore, crystalline silica is not a PBT substance.

IX. CLASSIFICATION AND LABELING

A. Classification

H373 – may cause damage to organs through prolonged or repeated exposure.

B. Labelling

Warning

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Eye Contact

Immediately flush open eyes with plenty of water for at least 15 minutes. Remove contacts, if present and easy to do. Get medical attention if symptoms persist.

Skin Contact

For minor skin contact, avoid spreading material on unaffected skin. Remove and isolate contaminated clothing. Wash the contaminated area of body with soap and fresh water. Launder contaminated clothing before reuse.

Inhalation

Move person to fresh air. Get medical attention if respiratory irritation develops or breathing becomes difficult.

Ingestion

Rinse mouth. Do not induce vomiting. Get medical attention if symptoms occur.

Notes to Physician

All treatments should be based on observed signs and symptoms of distress in the patient.

B. Firefighting Information

Extinguishing Media

Use extinguishing media appropriate for surrounding material.

Specific Exposure Hazards

Reacts with hydrofluoric acid (HF) forming toxic gas (SiF_4).

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus and chemical-protective clothing.

C. Accidental Release Measures

Personal Precautions

Isolate area. Keep unnecessary and unprotected personnel from entering the area. Use personal protective clothing. Ensure adequate ventilation. Wear respiratory protection if ventilation is inadequate. Do not breath mist, vapours or spray. Avoid contact with skin, eyes and clothing. Eliminate all sources of ignition.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

Pick up mechanically – vacuum up. Avoid generating dust. If formation of dust cannot be avoided, use respiratory filter device. Dispose of the material collected according to regulations.

D. Storage and Handling

General Handling

Handle in accordance with good industrial hygiene and safety practice. Avoid contact with eyes, skin and clothing. Avoid dust formation. Do not breathe dust. Wash thoroughly after handling. Use with adequate ventilation.

Storage

Provide adequate exhaust ventilation at places where dust is formed. Keep airborne concentrations below exposure limits. Keep containers tightly closed in a dry, cool, well-ventilated area.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

Workplace Australia has established an occupational exposure standard for exposure to crystalline silica of an 8-hour time weighed average (TWA) exposure limit of 0.05 mg/m^3.

Engineering Controls

Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Personal Protection Equipment

Respiratory Protection: If workers are exposed to concentrations above the exposure limit, they must use appropriate, certified respirators. If there are no applicable exposure limit requirements or guidelines, use an approved respirator. Selection of air-purifying or positive pressure supplied-air will depend on the specific operation and the potential airborne concentration of the product. For emergency conditions, use an approved positive-pressure self-contained breathing apparatus. The following should be effective types of air-purifying respirators: organic vapour cartridge with a particulate pre-filter.

Hand Protection: Use gloves chemically resistant to this material. Consult the SDS for appropriate glove barrier materials.

Skin Protection: Use protective clothing chemically resistant to this material. Selection of specific items such as face shield, boots, apron or full body suit will depend on the task.

Eye Protection: Use chemical goggles.

Other Precautions: Wash hands, forearms and face thoroughly after handling chemical products; as well as before eating, smoking and using the lavatory; and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Crystalline silica is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGEMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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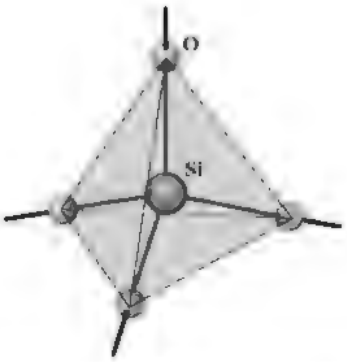
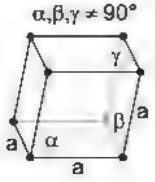
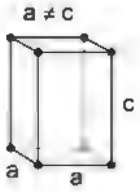
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Appendix

OECD-SIDS Initial Targeted Assessment Profile on Quartz and Cristobalite, SIAM 32, 19-21 April 2011

https://hpvchemicals.oecd.org/ui/handler.axd?id=b68bb357-e6dd-4db9-b05c-8148223fc0ff

INITIAL TARGETED ASSESSMENT PROFILE (Human Health)

CAS No.	Quartz: CAS RN 14808-60-7 Cristobalite: CAS RN 14464-46-1
Chemical Name	Quartz and Cristobalite
Structural Formula	Molecular Formula: SiO_2 
	Unit Cell: Trigonal symmetry  Quartz: CAS RN 14808-60-7
	Unit Cell: Tetragonal symmetry  Cristobalite: CAS RN 14464-46-1

SUMMARY CONCLUSIONS OF THE TARGETED ASSESSMENT

NOTE: The present assessment is targeted to address the following human health endpoints: repeated dose toxicity and carcinogenicity via the inhalation route of exposure, and genotoxicity. It cannot be considered as a full SIDS Initial Assessment. Summary information on exposure is also reported here. Other endpoints for human health and the environment included in the Canadian screening assessment but have not been presented to OECD member countries, and thus are not included in this profile.

The final screening assessment has been published under the responsibility of the Government of Canada. [http://www.ec.gc.ca/ese-ees/default.asp?lang=En&n=1EB4F4EF-1].

Rationale for Targeting the Assessment

The Government of Canada "categorized" or prioritized all 23,000 chemical substances on its Domestic Substances List (DSL) from 1999 to September 2006, as required by its *Canadian Environmental Protection Act, 1999* (CEPA 1999). Additional details may be found at http://www.chemicalsubstanceschimiques.gc.ca/about-apropos/categor/index-eng.php. Using information from Canadian industry, academic research and other countries, Government of Canada scientists applied a set of rigorous tools to the 23,000 chemical substances on the DSL. They were categorized to identify those that were: **inherently toxic** to humans or to the environment and that might be **persistent** and/or **bioaccumulative**; and substances to which people might have **greatest potential for exposure**. During this priority-setting exercise, distinct approaches were taken for identifying substances of likely concern for human health and the environment, and subsequent assessment activities may have focused on either human health or ecological

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endpoints. Through categorization, the Government of Canada has identified approximately 4,000 of the 23,000 chemical substances on the DSL as priorities for further assessment, research and/or measures to control their use or release. Quartz and cristobalite were identified at that time, applying the categorization criteria, as high priorities for human health risk because they were considered to pose greatest potential for exposure and their respirable forms are classified by the International Agency for Research on Cancer as carcinogenic to humans (quartz and cristobalite) and by the National Toxicology Program as known human carcinogens (crystalline silica). These substances did not meet the ecological categorization criteria for bioaccumulation potential or inherent toxicity to aquatic organisms.

Under the Canadian legislation a determination of whether one or more of the criteria of the CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) 1999, section 64 are met is based upon an assessment of potential risks to the environment and/or to human health associated with exposures in the general environment. For humans, this includes, but is not limited to, exposures from ambient and indoor air, drinking water, foodstuffs, and the use of consumer products. A conclusion under CEPA 1999 on the substances in the Chemicals Management Plan (CMP) Challenge is not relevant to, nor does it preclude, an assessment against the hazard criteria specified in the Controlled Products Regulations, which is part of the regulatory framework for the Workplace Hazardous Materials Information System [WHMIS] for products intended for workplace use.

Physical-chemical properties

The silicon dioxide group represents a polymorphic category containing a large number of forms identical in composition but with different atomic arrangements which afford different chemical properties. There are two sub-categories within this group: crystalline silica, to which the present substances quartz and cristobalite belong, and non-crystalline or amorphous silica. The key distinction between these sub-categories is that in crystalline substances, the building blocks are arranged in regular, repeating 3-dimensional pattern having long range order, whereas amorphous materials do not display long range order. In all forms of silica, (crystalline and non-crystalline), the silicon atom is tetrahedral and bound to four neighbouring oxygen atoms.

Quartz and cristobalite are solid at room temperature, existing normally as colourless or white crystals. The melting points for quartz and cristobalite are 1400-2000 ^{o}C and 1713-1728 ^{o}C, respectively and for both compounds, the boiling point is 2230°C. Even though no experimental data were available, their vapour pressure and Henry's Law constant are likely negligible. Log K_{ow} (octanol-water partition coefficient) and log K_{oc} (organic carbon-water partition coefficient) are not applicable to these substances. The densities range from 2500-2700 kg/m^3 for quartz and 2300-2380 kg/m^3 for cristobalite.

The very similar physico-chemical properties of quartz and cristobalite reflect their closely related crystal forms. The solubility of crystalline silicates decreases as a function of silica tetrahedral packing density and long-range crystal order. For example, cristobalite has a more open framework structure than quartz and its density is lower, therefore, its solubility is higher. The water solubility of these minerals is also function of temperature, pH, particle size, and the presence of a disrupted surface layer. This may explain the variability of solubility values reported by many authors. The most probable solubility value for quartz is approximately 3.8 mg Si/L, or 6.4 mg/L expressed as the SiO_2 species, while the solubility of cristobalite is approximately 8.7 mg Si/L, or 18 mg SiO_2/L. The kinetics of dissolution of these substances is slow due to the high activation energy required to hydrolyse the Si-O-Si bond.

Human Health Targeted Endpoints

The majority of the studies described here have been reviewed by the International Agency for Research on Cancer (IARC 1997). However, additional data relevant to the screening assessment were identified up to August 2010.

Repeated dose toxicity/non-neoplastic effects (development of silicosis).

Studies on animals

Significant short-term and subchronic studies have demonstrated adverse effects in the lungs, while one of the 6 studies showed effects on the spleen in mice. Rats were exposed to 0, 10 or 100 mg/m^3 of cristobalite via inhalation for 6 hours/day during 3 days. Animals were observed 3 months after exposure. Elevated levels of granulocytes and elevated markers of cytotoxicity from the lung lavage fluid were noted in all exposed groups. Another study of similar duration (9 days) conducted in mice also identified a LOAEC of 10 mg/m^3. Effects observed included minimal interstitial thickening, accumulations of mononuclear cells and slight lymphoid tissue hypertrophy in the lungs.

In a 4-week inhalation study, female rats were exposed to 0, 0.1, 1 or 10 mg/m^3 of quartz 6 hours/day, 5

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days/week. Bronchoalveolar lavage fluid was evaluated at 1, 8, and 24 weeks after exposure. Elevated levels of granulocytes and significant elevation of markers of cytotoxicity (Lactate dehydrogenase [LDH] and β-glucuronidase [β-glu]) were observed at 1 mg/m^3 and higher. The increased levels of LDH and β-glu were only significant at 24 weeks after exposure. A LOAEC of 1 mg/m^3 was identified at 24 weeks.

Male rats (4 animals per dose) were exposed to 0 or 3 mg/m^3 of cristobalite via inhalation for 6 hours/day, 5 days/week during 13 weeks. Pulmonary inflammation and fibrosis were observed in the exposed group at the end of treatment. When mice were similarly exposed to 5 mg/m^3 of quartz for 6 hours/day, 5 days/week for 15 or 27 weeks, the authors observed increased spleen weight and formation of plaque in the spleen.

In two separate studies, in which rats or hamsters were exposed to quartz via inhalation for at least 6 months, LOAECs of 2 and 3 mg/m^3 were identified, respectively. All the effects observed were related to inflammation and fibrosis of the lung tissue.

Several chronic studies investigated exposure of the respirable forms (i.e. accumulated via inhalation in the lung tissues) of quartz and cristobalite to rats, mice and hamsters. The following is a description of the study in which the lowest non-neoplastic LOAEC was determined. Groups of 50 rats/sex were exposed 6 hr/day, 5 days/week for 24 months to filtered air or 1 mg/m^3 of DQ-12 quartz, containing 74% of respirable quartz, through whole-body inhalation. An additional 50 rats/sex were exposed to 5 mg/m^3 of titanium dioxide as positive controls. The mean mass of particle at the end of the exposure period was 0.91 mg/lung. The LOAEC identified was 0.74 mg/m^3 (adjusted for 74% respirable quartz) based on lipoproteinosis, multifocal, inflammatory cell infiltrate and alveolar hyperplasia.

Human epidemiology data

In humans, the lowest observed adverse effect level was identified in a U.S. cohort study. The study was conducted on 3330 gold miners (all are males), who had an average of 9 years underground exposure during the period 1940 to 1965. The cohort was followed up through 1990. Silicosis[1] was identified through death certificates or chest X-rays. A job-exposure matrix together with work history was used to estimate individual exposure. The total silica content in the respirable dust in the mine was estimated at 13% and the median crystalline silica exposure was 0.05 mg/m^3. In this sub population of miners, 170 cases of silicosis were identified. The best predictor for risk of silicosis was cumulative exposure, which varied from less than 1% for a 0.5 mg/m^3-year exposure to 68-84% when exposed to more than 4 mg/m^3-year (based on the average daily dust exposure during the workday each year and summed over time for each miner). The main limitations identified

[1] Silicosis: Lung disease caused by inhalation of crystalline silica dust, and resulting in inflammation and scarring in forms of nodular lesions in the upper lobes of the lungs. By definition, clinically or pathologically diagnosed silicosis implies prior exposure to silica (Silicotics). It does not follow that a history of exposure to silica necessarily results in silicosis (Nonsilicotics). The typical "Silicotic" lung nodule is shown in Figure 1.



Figure 1. Silicotic nodule characterised by a central zone of hyalinised collagen with a whorled appearance and peripheral dust-containing macrophages (Rees and Murray, 2007).

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by the authors include the limited number of radiographic surveys, the potential bias from death certificates (relying on death certificates instead of relying on repeated x-rays, which were lacking for each miner, may have underestimated the number of cases) and the fact that the conversion of dust counts to

gravimetric measurements may not be accurate based on the estimation of 13% silica content in the respirable dust (although based on a relatively large number of samples (n = 82) collected in two different surveys, there was broad range of content in these samples (1% to 48%, SD = 9), and the percentage of respirable quartz may have differed in earlier years, but data were lacking for these years).

Two other human studies have identified similar LOAECs based on the critical endpoint of radiographic confirmed silicosis. A LOAEC of 0.053 mg/m^3 (mean exposure) was identified in a cross sectional study of South African gold miners and a LOAEC of 0.064 mg/m^3 (mean exposure) was derived in a mining community population-based random sample survey in Colorado.

Carcinogenicity studies

Studies on animals

Experimental studies conducted in rats have shown clear and consistent increases in lung tumours after chronic inhalation exposure. In the nine rat studies identified, five were inhalation studies and four were intratracheal instillation studies. All studies except one inhalation study showed increased incidence of lung tumours. For the inhalation studies with treatment related tumours, concentrations ranged from 1 to 50 mg/m^3 (1, 6, and 30 mg/m^3 of DQ-12 quartz; 12 and 50 mg/m^3 of Min-U-Sil 5 quartz) and duration of exposure ranged from 29 days to 2 years. In the inhalation study with no treatment-related tumours, exposure was 60 mg/m^3 of Sikron F300 quartz for 13 weeks. The following is a description of the neoplastic results in the study also identified as the critical study for non-neoplastic results. Groups of 50 rats/sex were exposed 6 hr/day, 5 days/week for 24 months to filtered air or 1 mg/m^3 of DQ-12 quartz through whole-body inhalation. An additional 50 rats/sex were exposed to 5 mg/m^3 of titanium dioxide as positive controls. In the exposed group, 18 animals developed tumours (12 in females, 5 in males), as opposed to 3 and 2 for the control and positive control groups respectively. The majority (10/18) of the tumours observed were adenocarcinomas. The mean mass of particles in the lungs at the end of the exposure period was 0.91 mg/lung.

For the intratracheal instillation studies, doses ranged from 4 to 57 mg/kg-bw (based on 7, 12 or 20 mg/animal of Min-U-Sil (5) quartz or 20 mg/animal of novaculite quartz). Exposure regimes were diverse and included single instillation with observation for up to two years, to weekly instillation for 10 weeks. It is noteworthy that the single intratracheal administration of a 95% pure quartz particles (<5 μm) resulted in an increased incidence of silicotic granulomas after 3 weeks and lung tumours after 11 months. The most common tumours reported across the long term rat studies were adenocarcinomas, however other tumours such as squamous-cell carcinoma, alveolar carcinoma and bronchiole-alveolar adenoma were also reported, and all animals that developed tumours also showed some degree of fibrosis.

Of particular interest is the intratracheal instillation study, investigating the sequence of pathological events leading to lung tumors. An unspecified number of rats/sex/dose received a single intratracheal instillation of various crystalline silica dusts or ferric oxide, allowing direct administration into the bronchial tree. The doses were 12 or 20 mg of Min-U-Sil 5 quartz (MQZ), 12 mg of hydrofluoric-acid-etched Min-U-Sil 5 quartz (HFMQZ), 12 mg of cristobalite, 12 mg of tridymite and 12 mg of ferric oxide suspended in saline. All groups were observed until six months post exposure, except for both MQZ groups, the HFMQZ and the ferric oxide group which were observed up until 17 months post-exposure. Interim sacrifices were conducted at 6, 11 and 17 months. The rat lungs showed a clear progression of effects. The sequence of pathological events were, an initial inflammatory response leading to a marked hyperplasia and hypertrophy of alveolar cells after one month, and at six months hyperplasia was evident but no lung tumours were observed. In this study, lung tumours were observed starting at the 11 month sacrifice with a 17% and 42% incidence in males and females (based on 3/18 males and 8/19 females), respectively, and at 17 months incidences were 32% and 59% (based on 6/19 males and 10/17 females, respectively). No lung tumours were found in ferric oxide treated rats. Similar studies have also been conducted in hamsters and mice. Although treated mice and hamsters showed treatment related signs (inflammation or fibrosis), no tumours were observed in hamsters. No increase in the incidence of lung tumours was seen in mice treated with quartz; however silicotic granulomas and lymphoid cuffing around airways but no fibrosis were seen in the lungs of quartz-treated mice.

Human epidemiology data

There is an extensive dataset of human studies investigating the link between crystalline silica exposure and cancer. IARC (1997) identified over 50 epidemiological studies based on occupational exposure to dust containing respirable crystalline silica. Main industry sectors from which the human data is derived include gold mines, foundries, granite/stone industry, pottery workers and refractory brick workers. From the least

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confounded studies, it was noted that lung cancer tended to increase with the following parameters: cumulative exposure; duration of exposure; peak intensity of exposure; presence of radiographically defined silicosis; and length of follow-up time from date of silicosis diagnostic. By definition, clinically or pathologically diagnosed silicosis implies prior exposure to silica (Silicotics).

Since the 1997 IARC report, a large number of epidemiological studies have been published, with the more recent studies being updates from supplementary follow-up of results from previously assessed case-control studies cohorts, new results based on refined exposure assessments or adjustment for confounders or meta-analyses of the pooled data from these epidemiology studies

In a meta-analysis of the data from 10 cohort studies of gold, tin and tungsten miners, granite workers, industrial sand, diatomaceous earth and pottery workers with quantitative exposure estimates for crystalline silica were pooled in order to analyse the risk related to lung cancer. The pooled cohort standardized mortality ratio (SMR, against national rates) [See Appendix 1 for definition] was 1.2 (Confidence Interval [CI] 1.1-1.3). The results from the case-control analyses show a statistically significant trend with duration of exposure (odds ratios (ORs) [See Appendix 1] by quintile of cumulative exposure increased from 1.0 to 1.6 [CIs of 0.85 to 2.1] and by quintile of average concentration increased from 1.0 to 1.7 [CIs of 1.1 to 2.3]), supporting the importance of the increasing lung burden of silica in the occurrence of cancer. Overall, the authors concluded that the results support the carcinogenicity conclusion presented by IARC (1997).

To investigate the link between crystalline silica, silicosis and lung cancer, epidemiological data published between 1966 and 2001 were gathered. Over 50 studies were selected and pooled according to type of study and the parameter being linked to lung cancer (i.e. silica exposure, presence of silicosis in subjects). The quality of study, adjustment for confounding factors, co-exposure to other carcinogens and availability of a more recent analysis of a same cohort were taken into consideration in the final selection of the studies. Analysis of the relationship between exposure to silica and lung cancer included 17 cohort and 13 case-control studies. For the analysis of lung cancer versus silicosis, 11 cohort and 5 case-control studies were selected. The third analysis included 6 cohort and 2 case-control studies to evaluate the risk of lung cancer in non-silicotics. A random effect model was used to conduct each meta-analysis. Pooled cancer risk ratios (RRs) were 1.32 (CI 1.23-1.41) for crystalline silica exposure, 2.37 (CI 1.98-2.84) for individuals exposed to silica with confirmed silicosis (Silicotics) and 0.96 (CI 0.81-1.15) for individuals with no evidence of silicosis (non-silicotics) with confirmed exposure to silica, supporting the general observation that silicosis has a stronger temporal relationship with crystalline silica exposure and furthermore support the view that a human silicotic response could be a preliminary stage in the development of cancer.

A more recent meta-analysis included 28 cohort, 15 case-control and two proportionate mortality ratio (PMR) [See Appendix 1] studies from a variety of occupational settings conducted between 1996 and 2005. Risk ratios (RRs) were calculated based on type of study and silicosis status using fixed and random effect models (results presented here are from the random model). RRs for all cohort studies was 1.34 (CI 1.25-1.45), and were 1.69 (CI 1.32-2.16) for silicotics, 1.25 (CI 1.18-1.33) for those with undefined silicosis status and 1.19 (CI 0.87-1.57) for non-silicotics. In the case-control studies, the general RR was 1.41 (CI1.18-1.67), and the same sub-groups as mentioned above resulted in RRs of 3.27 (CI 1.32-8.2), 1.41 (CI1.18-1.70) and 0.97 (CI 0.68-1.38), respectively. The proportionate mortality ratio for the last two studies was 1.24 (CI 1.05-1.47). The authors noted that the association between lung cancer and exposure to crystalline silica was more consistent for silicotics, i.e., those diagnosed with silicosis and RR values split into type of occupational settings in which participants worked.

Based upon the above three meta-analysis studies and the epidemiology studies discussed in IARC (1997), the following can be concluded. Lung cancer rates are higher in workers confirmed to have silicosis versus similarly exposed workers that do not have silicosis. Cancer risk is often more significant in workers exposed to crystalline silica over a 20 year period or to higher cumulative exposure levels; however a consistent finding is that the onset of silicosis, requires a smaller lag period than that for the appearance of tumours. Similarly, cancer risk is often more significantly associated at higher quintiles of exposure compared to the lower quintiles.

There have been reports of tumours outside of the lungs in persons with high silica exposure; however, these reports are sparse and the data inconsistent and have not been unequivocally linked to exposure to either one of the crystalline forms (quartz or cristobalite). Some of the reported locations are: oesophagus, stomach, liver, skin and bone. Sufficient epidemiological or toxicological data do not currently exist for quantitative assessment of the exposure-response relationship on these other tissues or organs.

Genotoxicity

Potential genotoxicity has been assessed in multiple *in vitro* and *in vivo* assays. Table 1 below gives a brief summary of the positive results observed in each type of assay.

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Table 1. Summary of positive results over total number of results for each assay and each category (all studies conducted with crystalline silica: quartz, except where indicated).

Assay	Animal data		Human data		Positives/Total	
	In vitro	In vivo	In vitro	In vivo[d]	In vitro	In vivo
Rec Assay	0/1				0/1	
DNA strand break	1/1	2/2	5/5[b]	1/1	6/6	3/3
Sister chromatid exchange	0/1		0/1[c]	1/1	0/2	1/1
Micronucleus	2/3	0/1	2/2[b]	1/1	4/5	1/2
Chromosome aberration	0/1			1/1	0/1	1/1
Aneuploidy/polyploidy	0/3				0/3	
Cell transformation	4/4				4/4	
Hprt mutation	1/2	2/2[a]	1/1[b]		2/3	2/2
Oxidative DNA damage		4/5	2/2		2/2	4/5
DNA binding		1/1				1/1
p53 activation		0/1				0/1

a. one assay conducted with crystalline silica: cristobalite
b. one assay conducted with “ultrafine crystalline silicon dioxide”.
c. crystalline silica: tridymite
d. crystalline silica dust (subtypes not provided).

All the *in vivo* human genotoxicity studies are based on three independent studies that used blood samples from workers from diverse occupational settings with confirmed exposures to crystalline silica dust; however, quantification of exposure was not provided. After stratification by smoking status, sister chromatid exchange remained statistically significant in both smokers and non-smokers although the frequency was higher in smokers. For the chromosome aberration assay conducted as part of the same study (blood samples from workers in the stone crusher industry), the increased frequency was no longer significant after stratification. In the DNA damage study of foundry and pottery workers and the micronucleus assay of workers involved in sandblasting and related jobs, results were positive when compared to controls. However, in both studies, smoking status influenced the results, contributing to the increased DNA damage observed since results were greater in smokers versus non-smokers, and the frequency of micronuclei in nasal epithelial cells was higher in smokers (p=0.002) but when using peripheral blood lymphocytes did not differ statistically between smokers and non-smokers who were similarly exposed to silica dust,

The role of *in situ* generation of reactive oxygen species (ROS) and reactive nitrogen species (RNS) has been well established in the following types of DNA damage: small scale insertions, DNA base pair deletion, base modification, chromosomal change/loss, microsatellite instability, DNA strand break, 8-hydroxydeoxyguanosine (8-OHdG) mutation and point mutations. ROS and RNS generation is postulated to be (a part of) the DNA damage mechanism for crystalline silica. Studies are described below to support this hypothesis.

DNA was exposed *in vitro* to various crystalline silica dusts, to H_2O_2, or to both. Results show that DNA damage was limited when dust or H_2O_2 were administered alone but increased with the co-exposure. When the reactive oxygen scavenger, dimethylsulfoxide, was added to the test system, DNA strand break was inhibited, data supporting the viewpoint that it is the presence of radicals generated in response to quartz and cristobalite that causes the DNA damage and not quartz or cristobalite themselves.

Hprt mutation assays in rat alveolar epithelial cells, both *in vitro* and *in vivo,* were positive in response to quartz. The positive results *in vivo* were seen only in the presence of significant inflammatory responses in the treated animals. Also, in a parallel *in vitro* experiment, rat alveolar epithelial cells were incubated with the bronchoalveolar lavage fluid from the rats exposed to quartz. Both macrophage and neutrophil enriched lavage cells induced mutation in the exposed alveolar epithelial cells. Addition of catalase (an enzyme which inactivates H_2O_2) before incubation inhibited the increase in *hprt* mutation.

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Rats were exposed to either crystalline or amorphous silica in a manner to induce the same level of inflammation in the lungs. The inflammatory response was assessed by measuring the proportion of neutrophils in the bronchiolar lavage fluid. The actual concentrations were 3 and 50 mg/m^3 for crystalline and amorphous silica respectively. The animals were exposed for 13 weeks. *Hprt* mutation frequency was measured in the alveolar epithelial cells at the end of the exposure period. Mutation frequency was greatly increased only in the crystalline silica treated rats; no treatment related increase was found in the rats treated with the amorphous form.

In an 8-OHdG assay conducted to monitor DNA damage by reactive oxygen species, female rats were exposed to 0, 0.3, 1.5 and 7.5 mg/animal of quartz via intratracheal instillation. Effects were observed 90 days post-exposure. A clear dose-response relationship was identified between quartz exposure and various inflammation markers (differential cell count, protein, lung surfactant lipids and tumour necrosis factor alpha). Inflammation was present starting at the lowest dose. However, 8-OHdG showed a statistically significant increase starting at 1.5 mg/animal only. Similarly, in another study, 8-OHdG and DNA strand breaks were observed at concentrations of or above 10 ug/m^3 in rat lung epithelial cells.

In the aim of investigating the role of ROS in lung carcinogenesis, rat lung epithelial cells were incubated with polymorphonuclear (PMN) leukocytes (involved in the inflammatory process and responsible for the release of certain ROS) or hydrogen peroxide. Statistically significant increases in 8-OHdG were observed in the presence of PMN or hydrogen peroxide in a dose-response manner.

In a series of experiments which used *in vitro* stimulation of macrophages with crystalline silica and *in vivo* intranasal instillation of crystalline silica in mice, it was demonstrated that that the chronic fibrosis seen in a murine model of silicosis *in vivo* is dependent on the presence of adaptor molecule ASC and Nalp3 inflammazome. These data support a potential mode of action whereby silica triggers cellular responses that in turn activate alveolar macrophages, resulting in an inflammatory response and silicosis. In mice deficient in Nalp3 inflammazome, the development of inflammation and collagen deposition was significantly reduced compared with normal mice 3 months after the initial intranasal instillation of silica.

Analysis of Lung Tumour Data

The weight of evidence for both rats and humans indicates that fibrotic and silicotic lesions in the lung result from inhalation exposure to crystalline silica and that lung cancer is secondary to those lesions in the lung. Although the mechanism of induction for the lung tumours has not been fully elucidated, there is sufficient supportive mode of action evidence from the data presented to demonstrate that a threshold approach to risk assessment is appropriate based on an understanding of the key events in the pathogenesis of crystalline silica induced lung tumours. The body of evidence include the following:

- In experimental studies, all rats that developed tumours also showed fibrosis.
- Adenocarcinomas, the most common type of tumour identified in rats, are commonly associated with fibrosis and deeply scarred lung tissue.
- Experimental rat studies showed a clear progression of the effects from initially mild inflammation, followed by fibrosis over-time, leading eventually to lung tumours.
- Tumours are not present in all treated species dosed in the same way.
- The tumours, both in rats and humans, are concentrated in the lungs only, although other organs are indirectly exposed.
- In human studies, cancer risk is often more significant in workers exposed over a 20 year period or to higher cumulative exposure levels; however a consistent finding is that the onset of silicosis, requires a smaller lag period than that for the appearance of tumours.
- Similarly, cancer risk is often more significantly associated at higher quintiles of exposure compared to the lower quintiles
- Lung cancer rates are higher in workers confirmed to have silicosis versus similarly exposed workers that do not have silicosis.
- For genotoxicity, in vitro results were mostly mixed and in vivo results were mostly positive. However, the vast majority of the positive genotoxicity assay results can be explained by the generation of reactive oxygen species, as demonstrated experimentally, where ROS scavenging prevents the genotoxicity.
- *In vivo*, macrophage deficient mice (macrophages produce ROS in response to crystalline silica) do not develop silicosis nor do they develop tumours and the Nalp3 inflammazome, a key player in the

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macrophage initiated inflammatory response, is required for the development of pulmonary fibrosis after inhalation of silica.

- Though inhalation exposure to crystalline silica in multiple occupational settings is clear, the increase in risk, based on the several recent meta-analyses of the multiple human epidemiological studies, remains low.

It is worth noting that where aggressive engineering controls have been made to reduce silica dust levels in the workplace (Sweden), silicosis has been eliminated. By corollary, existing exposures outside of the workplace in such areas do not pose a risk for silicosis to the general population.

The respirable forms of quartz and cristobalite possess properties indicating a hazard for human health (repeated dose toxicity, carcinogenicity and genotoxicity). The mode of action in the lungs involves irritation, inflammation and reactive species formation, leading to silicosis, and eventually to tumour formation.

Exposure

Uses

Consistent with oxygen and silicon being the two most abundant elements in the Earth's crust, silicon-oxide minerals, including quartz are ubiquitous in the natural environment. In particular, as a component of sand, quartz may find use in a diverse array of applications. Several high volume uses include, but are not limited to, the use of sand as a filling material for the construction of roads and in general building activities, the use of sand and gravel aggregates as abrasives on roads in winter and the use of fly-ash, which may contain 4-14% quartz and 0.5-1% cristobalite, as a cement additive. These abrasives when used on winter roads are usually mixed with road salts and may be sand only, stone dust, sand and gravel aggregates, or pre-treated sand. They are used mainly by rural municipalities or in areas where cold temperatures diminish the efficiency of salts for de-icing. Quantities of abrasives used in Canada were 5.73×10^9 kg, 4.59×10^9 kg, and 4.93×10^9 kg for 2007, 2008 and 2009, respectively.

Industrial sand, high purity silica sand products with closely controlled sizing are expected to contain quartz and cristobalite, include lump silica (2-3mm up to 15 cm or more), silica sand (75µm to 2-3mm) and silica flour (less than 75µm). Lump silica may be used in the production of silicon alloys, silica bricks, and the linings of certain types of pulverizers (eg. ball mills and tube mills).

Silica sand may be used in the manufacture of glass and glass fibres, silicate chemicals and silicon carbide, the hydraulic fracturing of wells, foundry moulding, and for sandblasting. Silica flour may find use in the ceramics and cement industries, as a filler and extender in rubber and coatings, and as an abrasive in soaps.

Natural clays, such as bentonite and fuller's earth, are used in cat litters for their high water absorbance capacities. Quartz is a natural component of these clays, and consequently, it may be present in cat litter products. High purity α-quartz is a piezoelectric material, which means that application of a voltage induces a distortion in the crystal shape and vice versa. This ability to interconvert electrical and mechanical energy has led to the use of quartz crystals in electronic devices requiring precise timing control, for example telephones, radios, watches and computers.

According to a survey conducted in Canada, quartz and cristobalite are also used in abrasives, adsorbents, filter products (diatomaceous earth), grout and cement. These substances reportedly also find use as fillers, which add bulk and improve wear resistance, in paints and coatings, adhesives, sealants, polymer films, caulking, epoxy resins and silicones. Also, quartz is listed as an ingredient in 60 cosmetic products in Canada. The types of products include anti-wrinkle preparation, eye and face makeup, lipstick, hair dyes, shampoos and grooming products, as well as skin cleansers, moisturizers and tanning preparations.

Natural Sources

In Canada, quartz naturally occurs in many types of rock formations. Those with high silicon dioxide content (95% SiO_2 or more) include vein and massive intrusion bodies, quartz pebbles, silica sand, sandstone and quartzite. Sandstone is a sedimentary rock mostly composed of quartz grains cemented by a bonding material such as clay, calcite or iron oxide. Quartzite is a hard, compact, metamorphosed sandstone made of grains of quartz firmly bonded with a siliceous cement. Mineral aggregates (e.g., sand and gravel) have variable silicon dioxide content. Quartz is also found as crystals, aggregates or discrete particles in certain igneous rocks (e.g., granites and pegmatites), soils, sediments, air and surface water. This omnipresence is consistent with the fact

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that silicon is the second most abundant chemical element on Earth.

Cristobalite is naturally produced in the ashes of volcanic eruptions, and by combustion metamorphism which is a local phenomenon of spontaneous combustion of naturally occurring substances such as bituminous rocks, coal or oil. It may be found in cavities in volcanic rocks and in thermally metamorphosed sandstones and may also be a transient stage in the diagenesis of diatomaceous shale with the result that soils made of these geologic formations may be rich in cristobalite. Unlike quartz, the natural occurrence of cristobalite is limited to specific geographic regions and mineral types.

Anthropogenic Sources

Natural quartz is isolated from ore via beneficiation, which involves milling or grinding the material into particles that are separated into desired mineral and waste. The materials obtained are either used directly or further purified. In Canada, in 2006, 2.146×10^{9} kg of pure quartz were mined, and 2.385×10^{11} kg of sand and gravel aggregates were produced. The proportion of quartz in silica sand deposits and gravel aggregates will vary from one site to another.

Cristobalite can form from silica melts during the preparation of silica glass; quartz is not obtained from melts but is manufactured at elevated temperature and pressure via a hydrothermal process. Cristobalite also forms during the calcination[2] of diatomaceous earth.

Human Exposure Estimate

Ambient air

The exposure assessment is focussed on respirable quartz and cristobalite, which in ambient air comprises a component of total particulate matter (PM). In Canada, data on the concentrations of silicon in PM was available and used as a surrogate for quartz and cristobalite. This approach is conservative because the measured silicon includes all silicon-containing substances and therefore represents the upper limit for quartz and cristobalite in ambient air.

The National Air Pollution Surveillance (NAPS) Program measured concentrations in $\mu g/m^3$ of silicon in PM with aerodynamic radii less than 2.5 μm ($PM_{2.5}$ (dichot)), and from 2.5 to 10 μm (PM_{10} (dichot)) (the total particulate matter with aerodynamic radii less than 10 μm (PM_{10}) is obtained by adding these values) in Canada. In 2009, as part of the NAPS Program, silicon concentrations were determined on over 1600 samples of $PM_{2.5}$(dichot) and over 1500 samples of PM_{10}(dichot) at 24 urban locations across Canada. An estimate of exposure to quartz and cristobalite can be obtained by assuming that all the silicon in the PM is represented stoichiometrically as SiO_2, and multiplying the reported concentration of silicon by 2.14 to obtain a value for silica.

The intake of respirable quartz and cristobalite by the general population of Canada is estimated using a range covering the lowest 50th percentile SiO_2 concentration in PM_{10}, measured in Pt. Petre, ON, (0.12 $\mu g/m^3$) to the highest 50th percentile concentration in PM_{10} measured in Calgary, AB (2.1 $\mu g/m^3$). The 50th percentile SiO_2 concentrations ranged from 0.1 to 2.1 $\mu g/m^3$ across the survey sites; the top of this range is quite close to the average of the maximum values for the 24 sites (3.7 $\mu g/m^3$). The outdoor data were used to represent the indoor levels, because information on indoor silicon concentrations was not available, and the range of PM_{10} measured indoors is generally lower than the outdoor range. Thus, this approach conservatively overestimates indoor exposure in homes.

The highest exposure group based on these calculations is children ages 0.5 to 4 years with an estimated daily intake ranging from 0.07 to 5.26 μg/kg-bw per day; the estimated daily intake decreases with age due to changes in the ratio of inhalation rates to body weights; the daily intake of adults, 20-59 years old, is estimated to range from 0.03 to 2.00 μg/kg-bw per day.

Consumer Products

Exposure to respirable quartz from the use of cosmetic products, which contained quartz as an ingredient, was considered low because they are not formulated for spray application, the loose powders were reported to contain less than 0.1% quartz, and in these products the substance is not expected to be associated with other components of the formulation and not available in a free form.

For consumer Do It Yourself (DIY) activities around the home, the highest mean breathing zone concentration

[2] Calcinations: Heat treating a substance, but without fusion, to bring about change in its physical or chemical constitution.

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of particles from sanding dry wall (median cut-point of 10μm) of 6.31 mg/m^3, was used to derive an upper-bound exposure estimate ranging from 2 to10 μg/kg-bw per event.

Quartz is used to formulate a large number of paints and coatings. To estimate potential inhalation exposure to quartz from these products, the spray painting of wall paints with an airless spray gun was considered appropriate as a conservative scenario. Exposure to respirable paint particles was estimated using data from controlled a laboratory study in which walls of poorly ventilated test rooms were painted by professional painters using an airless sprayer to apply interior latex paint. The maximum concentration of 13% quartz in paint in Canada was used to estimate exposure. The upper-bound estimate of exposure to quartz, based on the maximum concentration of 13% quartz in paint in the Canadian market and the maximum concentration of respirable paint particles measured in these controlled studies when recommended personal protective equipment is used, is 0.954 μg/kg-bw per event.

Inhalation of ambient air containing quartz and cristobalite is the dominant pathway of chronic exposure (excluding that from DIY activities) for the general population. Because SiO_2 makes up only approximately 5% of PM_{10}, silicon concentrations (expressed as SiO_2) measured in the Canadian NAPS survey of 24 urban locations were considered most relevant to the estimation of exposure by the general population. Quartz and cristobalite comprise only a portion of the total SiO_2 in PM_{10}, therefore, the use of the total silicon concentration to represent the upper bound crystalline silica concentrations results in an overestimation of exposure.

Appendix 1: Definitions of Epidemiological Terms in the ITAP

SMR (Standardized Mortality Ratio): The ratio (x 100) of observed to expected deaths in a study population. Expected deaths are calculated by applying a set of standard age-specific mortality rates to the age distribution of the study population. Standardized ratios are only useful for comparisons. They have no intrinsic meaning.

OR (Odds Ratio): In epidemiological case-control studies, a relative measure of disease occurrence. The odds in favour of a particular disease occurring in an exposed group are divided by the odds in favour of its occurring in an unexposed group. If the condition being studied is rare, the odds ratio is a close approximation to the relative risk.

RR (Risk Ratio): The probability of the occurrence of a disease in a group that has been exposed to some environmental, medicinal, microbial, or toxic influence, relative to its probability in a randomly selected population.

PMR (Proportionate Mortality Ratio): Proportionate mortality is the proportion of deaths in a specified population over a period of time attributable to different causes. Each cause is expressed as a percentage of all deaths, and the sum of the causes must add to 100%. These proportions are not mortality rates, since the denominator is all deaths, not the population in which the deaths occurred. Thus, proportionate mortality ratio is a measure of the frequency of occurrence of the proportionate mortality in a defined population during a specified interval of time.

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CYCLOHEXANEDIMETHANOL DIGLYDICYL ETHER

This dossier on cyclohexanedimethanol diglydicyl ether (CDGE) presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – CDGE is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

CDGE has industrial uses as a viscosity modifier and adjustor (NCBI, 2026).

CDGE is not readily biodegradable. It has a moderate potential for adsorption to soil, sediments and suspended solids and is hydrolytically unstable at pH 4, 7, and 9. It is not expected to bioaccumulate.

The acute and chronic toxicity of CDGE is of low concern to aquatic organisms. No toxicity data are available for terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): 2-{[(4-{[(oxiran-2-yl)methoxy]methyl}cyclohexyl)methoxy]methyl}oxirane

CAS RN: 14228-73-0

Molecular formula: $C_{14}H_{24}O_4$

Molecular weight: 256.34 g/mol

Synonyms: Cyclohexanedimethanol diglydicyl ether; 1,4-bis(glycidyloxymethyl)cyclohexane; oxirane, 2,2'-[1,4-cyclohexanediylbis(methyleneoxymethylene)]bis-; 1,4-bis[(2,3-epoxypropoxy)ethyl

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of CDGE

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Transparent liquid	1	ECHA
Melting Point	<-20°C @ 101.3 kPa	1	ECHA
Boiling Point	Decomposes @ 350°C before boiling	1	ECHA
Density	1080 kg/m^3 @ 20 °C	1	ECHA
Vapor Pressure	0.002 Pa @ 25°C	1	ECHA
Partition Coefficient (log K_{ow})	2.29 @ 30°C	1	ECHA
Water Solubility	3.7413 g/L @ 20°C	1	ECHA
Dissociation constant (pKa)	Study not technically feasible	-	ECHA
Viscosity	68.8 mPa s @ 20°C	1	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for CDGE.

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

CDGE is not readily biodegradable. It has a moderate potential for adsorption to soil, sediments and suspended solids and is hydrolytically unstable at pH 4, 7, and 9. It is not expected to bioaccumulate.

B. Partitioning

CDGE is moderately soluble in water. It has a low potential to volatilise from water or soil (ECHA). It is expected to by hydrolytically unstable at pH 4, 7, and 9. Hydrolysis of CDGE exceeded 10% after 5 days at each pH tested. (ECHA) [KI. Score = 1].

C. Biodegradation

In two ready biodegradation studies, the test substance CDGE did not meet the criteria of readily biodegradable. In an OECD 301F test, degradation after 34 days was approximately 19.1% as measured by biological oxygen demand (BOD). (ECHA) [KI. Score = 1]. In an OECD 301B test, degradation after 29 days was 23%. (ECHA) [KI. Score = 2].

If a chemical is found to be not readily biodegradable, it is categorised as Persistent since its half-life is substantially greater than 60 days (DoEE, 2017).

D. Environmental Distribution

No experimental data are available for CDGE. Based on an estimated soil organic carbon partition coefficient (K_{oc}) value of 331 L/kg (USEPA, 2026), if released to soil, the substance is expected to have moderate potential to adsorb to soil. If released to water, it is also likely to moderately adsorb to suspended solids and sediments. However, it is hydrolytically unstable at pH 4, 7 and 9 (ECHA).

E. Bioaccumulation

No experimental data are available for CDGE. CDGE is not expected to bioaccumulate based on a log K_{ow} of 2.29 (ECHA).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

The acute and chronic toxicity of CDGE is of low concern to aquatic organisms. No toxicity data are available for terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on cyclohexanedimethanol diglydicyl ether.

Table 3: Acute Aquatic Toxicity Studies on CDGE

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Oncorhynchus mykiss (Rainbow fish)	24-hr LC_{50}	17.5	1	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	16.3	1	ECHA

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Raphidocelis subcapitata (Green alga)	72-hr EC_{50}	26.7 (growth)	1	ECHA

Chronic Studies

No chronic studies were available for fish.

A 21-day NOEC of 11.7 mg/L was determined for Daphnia magna (ECHA). [Kl. Score = 1]

A 72-hour EC_{10} of 21.4 mg/L was determined for *Raphidocelis subcapitato* (green alga) based on growth (ECHA). [Kl. score = 1].

C. Terrestrial Toxicity

No studies were available for CDGE.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

CDGE is not readily biodegradable, and thus does meet the screening criteria for persistence.

Based on a measured log K_{ow} of 2.29, CDGE does not meet the screening criteria for bioaccumulation.

The lowest chronic NOEC in invertebrates and algae for CDGE is >0.1 mg/L. The acute $E(L)C_{50}$ values in fish, invertebrates and algae are >1 mg/L. Thus, CDGE does not meet the screening criteria for toxicity.

The overall conclusion is that CDGE is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for CDGE.

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8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
cyclohexanedimethanol diglydicyl ether (CDGE)	14228-73-0	Not a PBT	No	No	Yes	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

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B. Abbreviations and Acronyms

%	percent
°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
COC	constituent of concern
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre

IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
KI	Klimisch scoring system
K_{oc}	organic carbon-water partition coefficient
K_{ow}	octanol water partition coefficient
kPa	kilopascal
L	litre
L/kg	litres per kilogram
LC	lethal concentration
m^3	cubic metre
mg/L	milligrammes per litre
mg/m^3	milligrams per cubic metre
mL	millilitre
mPa s	millipascal second
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

DIETHYLENE GLYCOL MONOETHYL ETHER (DGME)

This dossier on diethylene glycol monoethyl ether (DGME) presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – DGME is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

DGME is a primary alcohol that is ethanol substituted by a 2-ethoxyethoxy group at position 2. It has a role as a protic solvent. It is a primary alcohol, a glycol ether, a diether and a hydroxypolyether.

DGME is readily biodegradable. It has a low potential for bioaccumulation. It is expected to not strongly adsorb to soil, suspended solids or sediment.

DGME is low toxicity concern for aquatic and terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): 2-(2-ethoxyethoxy)ethan-1-ol

CAS RN: 111-90-0

Molecular formula: $C_6H_{14}O_3$

Molecular weight: 134.175 g/mol

Synonyms: diethylene glycol monoethyl ether; DGME; ethanol, 2-(2-ethoxyethoxy)-; diethylene glycol ethyl ether

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of DGME

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Colourless liquid. Mild pleasant odour.	2	ECHA
Melting Point	-54.15°C @ 101.3 kPa	2	ECHA
Boiling Point	-195.85°C @ 101.3 kPa	2	ECHA
Density	989 kg/m^3@ 20°C	2	ECHA
Vapor Pressure	16.8 Pa @ 24.85°C	2	ECHA
Partition Coefficient (log K_{ow})	-0.54 @ 20°C	2	ECHA
Water Solubility	988.5 g/L @ 20°C	2	ECHA
Dissociation constant (pKa)	14.9 @ 20°C	2	ECHA
Viscosity	4.4 mPa s @ 20°C	2	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for DGME.

NICNAS has assessed DGME in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to the environment[1] .

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=7c59433e-f36b-1410-8924-008e64e216c7

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

DGME is readily biodegradable. It has a low potential for bioaccumulation. It is expected to not strongly adsorb to soil, suspended solids or sediment.

B. Partitioning

DGME is expected to volatilize from dry soil surfaces based on its vapour pressure but not volatilise from moist soil surfaces or water (NCBI, 2026). It has high water solubility (988.5 g/L; ECHA). It is not expected to undergo hydrolysis or direct photolysis in the aquatic environment (NCBI, 2026).

C. Biodegradation

DGME is readily biodegradable. In an activated sludge study under aerobic conditions, there was 100% degradation after 16 days, as determined by carbon dioxide evolution (ECHA) [KI. Score = 2].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

D. Environmental Distribution

Based on a log soil organic carbon partition coefficient (K_{oc}) of -0.16 (K_{oc} of 0.69 L/kg), DGME is expected to have high mobility in soil and it is not expected to strongly adsorb to soil (ECHA). If released to water, based on this K_{oc} value and its high water solubility, it also would not be expected to strongly adsorb to suspended solids and sediment.

E. Bioaccumulation

Based on a low log K_{ow} of -0.54, DGME has low potential for bioaccumulation (ECHA). This is supported by a low estimated BCF of 3 L/kg (NCBI, 2026).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

DGME is low toxicity concern for aquatic and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on DGME.

Table 3: Acute Aquatic Toxicity Studies on DGME

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Ictalurus punctatus (Channel catfish)	96-hr LC_{50}	6,010	2	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	1,982	2	ECHA
Raphidocelis subcapitata (Green algae)	72-hr EC_{50}	14,861 (growth)	2	ECHA

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on DGME.

Table 4: Chronic Aquatic Toxicity Studies on DGME

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Fish	30-day ChV	1,561 (QSAR)	2	ECHA
Daphnia magna (Water flea)	21-day ChV	480 (QSAR)	2	ECHA
Green algae	96-hr ChV	415 (growth, QSAR)	2	ECHA

Note: ChV = chronic value, defined as the geometric mean of the NOEC and LOEC

C. Terrestrial Toxicity

No studies available. No testing is required due to DGME's low potential for adsorption and no indication that the substance is very toxic (ECHA).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

DGME is readily biodegradable; thus, it does not meet the screening criteria for persistence.

Based on a measured log K_{ow} of -0.54, DGME does not meet the screening criteria for bioaccumulation.

The lowest chronic value for DGME is >0.1 mg/L in algae. The acute $E(L)C_{50}$ values are >1 mg/L in fish, invertebrates and algae. Thus, DGME does not meet the screening criteria for toxicity.

The overall conclusion is that DGME is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for DGME.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
DGME	111-90-0	Not a PBT	No	No	No	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
COC	constituent of concern
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard

IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
Kl	Klimisch scoring system
KOCWIN™	USEPA organic carbon partition coefficient estimation model
kPa	kilopascal
L	litre
L/kg	litres per kilogram
LC	lethal concentration
m^3	cubic metre
MCI	molecular connectivity index
mg/kg	milligrams per kilogram
mg/L	milligrammes per litre
mg/m^3	milligrams per cubic metre
mL	millilitre
mPa s	millipascal second
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

DIETHYLTOLUENEDIAMINE

This dossier on diethyltoluenediamine presents the most critical studies pertinent to the risk assessment of this substance in its use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion –Diethyltoluenediamine was assessed as a tier 1 chemical for acute toxicity in fish and algae and as a tier 2 chemical for acute toxicity in invertebrates. Diethyltoluenediamine was assessed as a tier 1 chemical for chronic toxicity in algae. Diethyltoluenediamine is not readily biodegradable suggesting that chronic lab data would be more relevant than acute results. Therefore, this substance is classified overall as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

Diethyltoluenediamine is an aromatic amine used as a chain extender or crosslinking agent in epoxy formulations.

Diethyltoluenediamine is not readily biodegradable. It is not expected to strongly adsorb to soil, suspended solids and sediment. It has a low potential for bioaccumulation.

The acute and chronic toxicity of diethyltoluenediamine is of low concern to aquatic organisms. There is also low potential for risk to terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): 3,4-diethyl-6-methylbenzene-1,2-diamine

CAS RN[1]: 68479-98-1

Molecular formula: $C_{11}H_{18}N_2$

Molecular weight: 178.3 g/mol

Synonyms: Diethyltoluenediamine; diethylmethylbenzenediamine; benzenediamine, ar,ar-diethyl-ar-methyl-; Ethacure 100; DETDA

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

[1] Alternate CAS RN 75389-89-8 for mixture of two isomers

Table 1: Overview of the Physico-chemical Properties of Diethyltoluenediamine

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Clear yellow liquid	2	ECHA
Melting Point	Liquid at room temperature	2	ECHA
Boiling Point	308.3°C @ 101.3 kPa	2	ECHA
Density	1019 kg/m^3@ 20 °C	2	ECHA
Vapor Pressure	0.11 Pa @ 20°C	2	ECHA
Partition Coefficient (log K_{ow})	1.38 @ 25°C	1	ECHA
Water Solubility	23 g/L @ 30°C	2	ECHA
Dissociation constant (pKa)	4.6 @ 20°C	2	ECHA
Viscosity	286 mPa s @ 20°C	2	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for diethyltoluenediamine.

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Diethyltoluenediamine is not readily biodegradable. It is not expected to strongly adsorb to soil, suspended solids and sediment. It has a low potential for bioaccumulation.

B. Partitioning

Diethyltoluenediamine is highly soluble in water. Volatilisation from water and moist soil is not expected to be an important fate process based upon its Henry's Law Constant (1.61 x 10^{-3} to 2.66 x

10^{-4} Pa m^3/mol) (ECHA). It is also not expected to volatilise from dry soil surfaces based upon its estimated vapour pressure (0.11 Pa).

C. Biodegradation

In a weight of evidence approach with a poorly described experimental study [Kl. Score = 4] and a QSAR model [Kl. Score = 2], sufficient information is available to classify diethyltoluenediamine as not biodegradable. The experimental data showed less than 1 % biodegradation after 28 days. This experimental value is supported by Biowin3 and Biowin4 models which yielded estimates of weeks to months for the time required to achieve complete ultimate and primary biodegradation of the substance in a typical or "evaluative" aquatic environment (ECHA).

If a chemical is found to be not readily biodegradable, it is categorised as Persistent since its half-life is substantially greater than 60 days (DoEE, 2017).

D. Environmental Distribution

No experimental data are available for diethyltoluenediamine. Using KOCWIN in EPISUITE™ (USEPA, 2019), the estimated soil organic carbon partition coefficient (K_{oc}) value from the molecular connectivity index (MCI) and log K_{ow} methods are 551 and 44 L/kg, respectively (ECHA) [Kl. Score = 2].

Based on these K_{oc} values, if released to soil, diethyltoluenediamine has low to moderate potential for adsorption. If released to water, with its high water solubility (23 g/L), it is not expected to strongly adsorb to suspended solids and sediment.

E. Bioaccumulation

No experimental data are available for diethyltoluenediamine. Diethyltoluenediamine is not expected to bioaccumulate based on a log K_{ow} of 1.38 and an estimated BCF of 3.78 L/kg ww using a log K_{ow} of 1.12 (ECHA). [Kl. Score = 2]

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

The acute and chronic toxicity of diethyltoluenediamine is of low concern to aquatic organisms. There is also low potential for risk to terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on diethyltoluenediamine.

Table 3: Acute Aquatic Toxicity Studies on Diethyltoluenediamine

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Pimephales promelas (Fathead minnow)	96-hr LC_{50}	>106	1	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	5.8	1	ECHA
Desmodesmus subspicatus (Green alga)	72-hr EC_{50}	104 (growth)	1	ECHA

Chronic Studies

No chronic studies were available for fish or invertebrates.

A 72-hour EC_{10} of 54 mg/L was determined for *Desmodesmus subspicotus* (green alga) based on growth. A 72-hour NOEC for growth rate could not be calculated as the replication of the test was to low for applying the Mann-Whitney-U test. The 48-hour NOEC value was 32 mg/L. In cases where the 72-hour NOEC is not available, the EC_{10} value is used for regulatory assessment (ECHA). [Kl. score = 1].

C. Terrestrial Toxicity

No studies are available for diethyltoluenediamine. Testing was not required based on the low potential for risk to terrestrial organisms (ECHA).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REAC Criteria methodology (IChEMS, 2022; ECHA, 2023).

Diethyltoluenediamine is not readily biodegradable; thus, it meets the screening criteria for persistence.

Based on a measured log K_{ow} of 1.38, diethyltoluenediamine does not meet the screening criteria for bioaccumulation.

The lowest chronic NOEC for diethyltoluenediamine is >0.1 mg/L in algae. The acute $E(L)C_{50}$ values are >1 mg/L in fish, invertebrates and algae. Thus, diethyltoluenediamine does not meet the screening criteria for toxicity.

The overall conclusion is that diethyltoluenediamine is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for diethyltoluenediamine.

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8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
Diethyltoluenediamine	68479-98-1	Not a PBT	No	No	Yes	No	No	No	1 (Fish & Algae), 2 (Inv)	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

%	percent
°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
BCF	bioconcentration factor
COC	constituent of concern
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry

kg	kilograms
Kl	Klimisch scoring system
K_{oc}	organic carbon-water partition coefficient
K_{ow}	octanol water partition coefficient
kPa	kilopascal
L	litre
L/kg	litres per kilogram
LC	lethal concentration
m^3	cubic metre
mg/L	milligrammes per litre
mL	millilitre
mPa s	millipascal second
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

DIMETHYLAMINOPROPYLAMINE

This dossier on dimethylaminopropylamine presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed dimethylaminopropylamine in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to the environment.[1]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): (3-aminopropyl)dimethylamine

CAS RN: 109-55-7

Molecular formula: $C_5H_{14}N_2$

Molecular weight: 102.181 g/mol

Synonyms: dimethylaminopropylamine; 3-aminopropyldimethylamine; 1,3-propanediamine, N1,N1-dimethyl-; N,N-dimethyl-1,3-propanediamine; 3-dimethylaminopropylamine

SMILES: CN(C)CCCN

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of dimethylaminopropylamine

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Colourless liquid	2	ECHA
Melting Point	-70°C @ 101.3 kPa	2	ECHA
Boiling Point	135.1°C @ 101.3 kPa	2	ECHA
Density	813 kg/m^3@ 25°C	2	ECHA
Vapour Pressure	590 Pa @ 20°C	2	ECHA
Partition Coefficient (log K_{ow})	-0.352 @ 25°C	2	ECHA
Water Solubility	1000 g/L @ 20°C	2	ECHA
Flash Point	30.5°C	2	ECHA

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=8958433e-f36b-1410-8924-008e64e216c7

Property	Value	Klimisch Score	Reference
Auto flammability	217°C	2	ECHA
Viscosity	1.6 mPa s @ 20°C	2	ECHA
Henry's Law Constant	0.000671 Pa m^3/mol@ 25°C	2	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Dimethylaminopropylamine is readily biodegradable. It is not expected to bioaccumulate. It is not expected to adsorb to soil, sediment or suspended solids.

B. Biodegradation

Dimethylaminopropylamine is readily biodegradable. In an activated sludge study under aerobic conditions, there was 65% degradation after 20 days, as determined by oxygen consumption (ECHA) [Kl. Score = 2].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

Dimethylaminopropylamine will primarily exist as a cation in the environment. Based on a log K_{oc} of 1.81 (K_{oc} of 65 L/kg), dimethylaminopropylamine is expected to be mobile in soil and is not expected to strongly adsorb. If released to water, based on this K_{oc} value and its high water solubility (1,000 g/L), it is expected to preferentially partition to the water column.

D. Bioaccumulation

Based on a log K_{ow} of -0.352, dimethylaminopropylamine has low potential for bioaccumulation. This is supported by an estimated BCF of 2.4 L/kg (ECHA). [Kl. Score = 2]

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Dimethylaminopropylamine exhibits low acute toxicity via the oral, inhalation and dermal routes. It is a skin and respiratory irritant. It is also a skin sensitiser. Dose-related systemic effects or target organ toxicity was not observed in repeat dose studies. The substance is not genotoxic when tested in both *in vitro* and *in vivo* assays. It is not a reproductive or developmental toxicant.

B. Metabolism

There is no data available on the metabolism, toxicokinetics and/or distribution of dimethylaminopropylamine once absorbed. Primary aliphatic amines, such as dimethylaminopropylamine, are generally metabolised to the corresponding carboxylic acid and urea (ECHA).

C. Acute Toxicity

Oral

An OECD Guideline 401 (Acute Oral Toxicity) test was conducted for male and female Sprague-Dawley rats administered dimethylaminopropylamine by oral gavage at 320, 630 and 1000 milligrams per kilogram body weight (mg/kg-bw). Animals were observed for 14 days following oral gavage for mortality, body weight and gross pathology. In addition to clinical signs, mortality was observed in 1 male and 2 females at 320 mg/kg-bw, 4/5 males and females at 630 mg/kg-bw and in all animals at 1000 mg/kg-bw. A combined estimated LD50 of 410 mg/kg-bw was derived for dimethylaminopropylamine based on this study (ECHA). [Kl. Score = 1]

Inhalation

Few studies are available for the acute inhalation toxicity of dimethylaminopropylamine. An unpublished OECD Guideline 403 (Acute Inhalation Toxicity) test was conducted on male and female Wistar rats exposed for 4 hours to measured concentrations of 4.31 milligrams per litre (mg/L) in air. No mortality was observed with temporary clinical observations (accelerated breathing and restlessness) resolving after the first 24 hours of a 14-day observation period. No other effects on body weight or gross pathological findings were noted. Based on this study, the LC50 for dimethylaminopropylamine was determined to be >4.31 mg/L (4,310 mg/m^3) (ECHA). [Kl. Score = 1]

Dermal

An unpublished OECD Guideline 402 (Acute Dermal Toxicity) test was conducted on male and female Sprague-Dawley rats. First, a preliminary study was conducted on a single male and female rat exposed dermally to a concentration of 1000 or 2000 mg/kg-bw dimethylaminopropylamine for 24 hours and observed for 5 days. Both animals exposed to 2000 mg/kg-bw died on day 2 post exposure. A supplemental study exposed male and female rats to 400 mg/kg-bw under similar exposure conditions and were observed for 14 days post exposure. After 14 days, no mortality or other clinical signs, including irritation, were observed. Therefore, the LD50 for dermal exposure to dimethylaminopropylamine is >400 <2000 mg/kg bw (ECHA). [Kl. Score = 1]

A similar OECD Guideline 402 study was conducted on male and female New Zealand White rabbits dermally exposed to dimethylaminopropylamine for 24 hours at concentrations of 1000, 2000, and 3000 mg/kg-day. After 14 days of observation post-exposure, high mortality was observed at 3000 mg/kg-day. Based on this study, a dermal LD50 of 2138.7 mg/kg-bw was derived for dimethylaminopropylamine (ECHA). [Kl.=Score =1]

D. Irritation

Skin

In a BASF dermal test, two Vienna White rabbits were exposed on untreated skin to undiluted dimethylaminopropylamine for 1, 5 and 15 minutes (min) and observed for three weeks post treatment. After 15 min of exposure, haemorrhages and other reversible effects were observed with only increased hair growth observed at the end of the observation period. Based on this study, dimethylaminopropylamine is identified as Category 1B (corrosive) for skin based on GHS criteria (ECHA). [Kl. Score = 2]

Eye

In a BASF ocular test, 0.05 mL of undiluted dimethylaminopropylamine was applied to the conjunctival sac of one eye in two rabbits (unspecified strain) and clinicals findings recorded after 10 min, 1 hr, 24 hrs and periodically throughout the observation period (14 days). After 10 min (and up to six days after), severe irreversible corrosion to the eyes were recorded. Based on this study, dimethylaminopropylamine is identified as Category 1 (irreversible effects on the eye) based on GHS criteria (ECHA). [Kl. Score = 2]

E. Sensitisation

In a key *in vivo* test, an OECD Guideline 429 (Skin Sensitisation: Local Lymph Node Assay) test was conducted on female CBA mice at concentrations of 0.5, 1, 2.5, 5, and 10% dimethylaminopropylamine in acetone/olive oil. At the 5 and 10% test concentrations, the stimulation index (SI) value of 3 was exceeded, indicating an increase in lymph node cell proliferation activity. Based on this study, an EC3 of 2.2% was derived for dimethylaminopropylamine. Based on this, dimethylaminopropylamine is noted to be a moderate sensitiser based on *in vivo* and *in vitro* assays (ECHA). [Kl. Score = 2]

F. Repeated Dose Toxicity

Oral

An OECD guideline 407 study (Repeated Dose 28-Day Oral Toxicity Study in Rodents) was conducted for male and female Wistar rats orally gavaged with dimethylaminopropylamine in water at 10, 50 and 250 mg/kg-bw daily for 28 days. In the 250 mg/kg-bw dose group, mortality and clinical signs (e.g., swollen abdomen, respiratory sounds) were observed. Other recorded observations, including body/organ weight, clinical chemistry, urinalysis, haematology, and gross and histopathological findings were not statistically significant from controls and/or considered dose-related. Based on this study, a NOAEL of 50 mg/kg-bw was identified for dimethylaminopropylamine (ECHA). [Kl. Score = 1]

An OECD guideline 408 study (Repeated Dose 90-Day Oral Toxicity Study in Rodents) was conducted for male and female Sprague-Dawley rats orally gavaged with dimethylaminopropylamine in water at 50, 250 and 750 mg/kg-bw daily for 90 days. In the 750 mg/kg-bw dose group, treatment-related clinical effects in the female rats, including hunched posture, dyspnoea, loud breathing and posture were observed. Other recorded observations, including mortality, body/organ weight, clinical chemistry, ophthalmological findings, urinalysis, haematology, and gross and histopathological findings were not statistically significant from controls or considered to be dose-related. Based on this study, a NOAEL of 250 mg/kg-day was identified for dimethylaminopropylamine (ECHA). [Kl. Score = 1]

Inhalation

A study of factory workers exposed to airborne concentrations of dimethylaminopropylamine consisted of an initial field study and a subsequent follow up cross sectional study. In this study, worker exposures and reported and observed respiratory effects were evaluated. At an average concentration in air of 0.55 milligrams per cubic meter of air (mg/m3), only mild respiratory irritation with no impairment of lung function was observed. Based on this study, a lowest-observed-effect-level (LOEL) would be in the range of 0.425-0.85 mg/m3 (Brubaker et al. 1979 as cited by ECHA). [Kl. Score = 2]

Dermal

No studies available.

G. Genotoxicity

Based on the results of the *in vivo* and *in vitro* assays, dimethylaminopropylamine is not considered to be classified for genetic toxicity (ECHA).

In Vitro Studies

The *in vitro* genotoxicity studies on dimethylaminopropylamine are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on Dimethylaminopropylamine

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay) (*Salmonella typhimurium TA1538, TA1537, TA1535, TA98, TA100*)	-	-	1	ECHA
OECD Guideline 473 equivalent (*In vitro* Mammalian Chromosome Aberration Test) (human lymphocytes)	-	-	1	ECHA
OECD Guideline 476 equivalent (*In vitro* Mammalian Cell Gene Mutation Test) (mouse lymphoma cells (L5178Y))	-	-	1	ECHA

*+, positive; -, negative

In Vivo Studies

An OECD Guideline 474 (Mammalian Erythrocyte Micronucleus) test was conducted on male and female NMRI mice. Test subjects were intraperitoneally injected with dimethylaminopropylamine and water at concentrations of 25, 50, and 100 mg/kg-bw. After 24 hours, bone marrow cells were collected and evaluated for frequency of micronuclei in polychromatic erythrocytes at each dose and an additional test after 48 hours was conducted at the 100 mg/kg-bw dose only. Although mortality of test subjects was observed at the 150 mg/kg-bw dose and higher, no increases in genotoxicity were observed and dimethylaminopropylamine was classified as negative (ECHA). [Kl. Score = 1]

H. Carcinogenicity

There are no available studies for the carcinogenicity of dimethylaminopropylamine.

I. Reproductive Toxicity

No studies are available on dimethylaminopropylamine. An OECD Guideline 443 (Extended One-Generation Reproductive Study) for read-across substance diethylaminopropylamine (DEAPA) (CAS RN 104-78-9) was conducted on male and female Sprague-Dawley rats. Test subjects were orally gavaged with DEAPA and water at 40, 150 and 450 mg/kg-bw for 10 weeks for males and 8-10 weeks for females (until weaning of F1 generation pups). F1 generation pups were treated similarly as the prior F0 generation prior to mating and until weaning of F2 pups. No treatment related effects,

including mortality and reproductive effects, were observed. From this study, a NOAEL of 450 mg/kg-day was derived for reproductive effects (ECHA). [Kl. Score = 1]

J. Developmental Toxicity

No studies are available on dimethylaminopropylamine. An OECD Guideline 414 (Prenatal Developmental Toxicity Study) for DEAPA, was conducted on female New Zealand White rabbits. Test subjects were orally gavaged with DEAPA and water at 15, 50 and 130 mg/kg-bw from day 6 to day 28 post coitum. No treatment related effects, including mortality and developmental effects, were observed at any of the dose regimens compared to controls. From this study, a NOAEL of 130 mg/kg-day was derived for reproductive effects of DEAPA (ECHA). [Kl. Score = 1]

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for dimethylaminopropylamine follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

~~Oral~~

An OECD Guideline 407 oral subchronic study for dimethylaminopropylamine was conducted on male rats. The NOAEL from this study is 50 mg/kg-day based on no effect for survival, clinical signs of toxicity, clinical chemistry, urinalysis, haematology, body/organ weight and gross and histopathological findings. This NOAEL will be used to derive an oral reference dose and drinking water guideline value for dimethylaminopropylamine.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 50/(10 x 10 x 1 x 10 x 1) = 50/1000 = 0.05 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.05 x 70 x 0.1)/2 = 17.5 mg/L

B. Cancer

No oral studies were available for the carcinogenicity of dimethylaminopropylamine. Thus, a cancer reference value for the substance was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Dimethylaminopropylamine is flammable. It does not exhibit the following physico-chemical properties:

- Explosivity
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Dimethylaminopropylamine is expected to have low acute and chronic toxicity to aquatic organisms. No studies are available for terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on dimethylaminopropylamine.

Table 3: Acute Aquatic Toxicity Studies on Dimethylaminopropylamine

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Leuciscus idus melanotus (Golden orfe fish)	96-hr LC_{50}	122	2	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	59.5	2	ECHA
Raphidocelis subcapitata (Green algae)	72-hr EC_{50}	34 (growth)	2	ECHA

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on dimethylaminopropylamine.

Table 4: Chronic Aquatic Toxicity Studies on Dimethylaminopropylamine

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Daphnia magna (Water flea)	22-day NOEC	3.64	1	ECHA

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Raphidocelis subcapitata (Green algae)	72-hr NOEC	19.53 (growth)	2	ECHA

C. Terrestrial Toxicity

No studies available and none were required. Indirect exposure to the soil compartment is unlikely since the substance is readily biodegradable (ECHA).

D. Calculation of PNEC

The PNEC calculations for dimethylaminopropylamine follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (122 mg/L), invertebrates (59.5 mg/L), and algae (34 mg/L). NOEC values from long-term studies are available for invertebrates (3.64 mg/L) and algae (19.53 mg/L). On the basis that the data consists of short-term results from three trophic levels and long-term results from two trophic levels, an assessment factor of 100 has been applied to the lowest reported NOEC value of 3.64 mg/L for invertebrates. The $PNEC_{water}$ is 0.0364 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 0.058 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (2.04/1280) \times 1000 \times 0.0364$
$= 0.058$ mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 2.58/1000 \times 2400]$
$= 2.04\ m^3/m^3$

Where:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
$= 65 \times 0.04$
$= 2.58$ L/kg

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for dimethylaminopropylamine calculated from EPISUITE™ using the MCI is 65 L/kg.

F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are no toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 0.031 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$

$= (1.29/1500) \times 1000 \times 0.0364$

$= 0.031$ mg/kg

Where:

Kp_{soil} = soil-water partition coefficient (m^3/m^3)

BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]

$Kp_{soil} = K_{oc} \times f_{oc}$

$= 65 \times 0.02$

$= 1.29\ m^3/m^3$

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for dimethylaminopropylamine calculated from EPISUITE™ using the MCI is 65 L/kg.

F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Dimethylaminopropylamine is readily biodegradable and thus does not meet the screening criteria for persistence.

No data are available on bioaccumulation. However, based on the log K_{ow} of -0.352 L/Kg, bioaccumulation is not expected. Thus, dimethylaminopropylamine does not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on dimethylaminopropylamine in invertebrates and algae are > 0.1 mg/L. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies on dimethylaminopropylamine in fish, invertebrates and algae are > 1 mg/L. Thus, dimethylaminopropylamine does not meet the criteria for toxicity.

The overall conclusion is that dimethylaminopropylamine is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Acute toxicity Category 4 H302 (Oral)

Skin Corrosion Category 1B H314

Skin sensitisation Category 1, H317

Flammable liquid Category 3 H226

B. Labelling

Danger

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses if possible.

Skin Contact

Flood affected skin with water and remove contaminated clothes. Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Half-upright position. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear full-body protective clothing and use self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed. Isolate the spill or leak for at least 50 meters in all directions.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place. It is recommended that this material be stored in a refrigerator. Keep separated from strong oxidants, strong acids and food and feedstuffs.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard for dimethylaminopropylamine in Australia is not available.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Dimethylaminopropylamine is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Prior to implementing land disposal of waste residue (including waste sludge), consult with environmental regulatory agencies for guidance. Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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DIPROPYLENE GLYCOL

This dossier on dipropylene glycol presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed dipropylene glycol in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to human health and the environment.[1] [2]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): propane-1,2-diol

CAS RN: 25265-71-8

Molecular formula: $C_6H_{14}O_3$

Molecular weight: 268.35 g/mol

Synonyms: Propanol, oxybis-, Dipropylene glycol, Oxybispropanol

SMILES: CC(CO)OC(C)CO.CC(COCC(C)O)O

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of Dipropylene Glycol

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Clear colourless liquid.	1	ECHA
Melting Point	<-20°C @ 101.3 kPa	2	ECHA
Boiling Point	227°C @ 101.3 kPa	2	ECHA
Density	1020 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	1.3 Pa @ 25°C	2	ECHA
Partition Coefficient (log K_{ow})	-0.46 @ @ 20 °C	2	ECHA
Water Solubility	Miscible	1	ECHA
Flash Point	129.85°C	2	ECHA

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=2994433e-f36b-1410-8c14-0026b2c59b62
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=faf1433e-f36b-1410-8e4e-00f1fcf8411a

Property	Value	Klimisch Score	Reference
Auto flammability	331.85°C	2	ECHA
Viscosity	120 mPa s @ 20°C	1	ECHA
Henry's Law Constant	0.000907 Pa m^3/mol @ 12°C	2	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Dipropylene glycol is readily biodegradable. It is not expected to bioaccumulate. It is expected to have high mobility in soil, and it is not expected to adsorb to soil or sediment.

B. Biodegradation

Dipropylene glycol is readily biodegradable. In an activated sludge study under aerobic conditions, there was 84.4% degradation after 28 days based on oxygen consumption, 64.5% based on carbon dioxide evolution, and 93.4% based on loss of dissolved organic carbon (ECHA) [Kl. Score =1].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

Based on a log K_{oc} of 0.78 (K_{oc} of 6.04 L/kg), dipropylene glycol is expected to have high mobility in soil and it is not expected to strongly adsorb to soil or sediment (ECHA). If released to water, based on this K_{oc} value and its water solubility, it is expected to preferentially partition to the water column.

D. Bioaccumulation

Based on a low log K_{ow} of -0.46, dipropylene glycol has low potential for bioaccumulation (ECHA).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Dipropylene glycol exhibits low acute toxicity via the oral, dermal and inhalation route. It is not irritating to the skin, eyes or respiratory tract and is not a skin sensitiser. Repeated oral exposures via drinking water to rats have resulted in systemic toxicity with target organ effects in the liver and kidneys. The substance is not genotoxic when tested in both in vitro and in vivo assays and is not considered mutagenic or carcinogenic after a two year chronic study in both mice and rats. It is not a reproductive or developmental toxicant.

B. Metabolism

There are no data available on the metabolism, toxicokinetics and/or distribution of dipropylene glycol. However, toxicokinetic data for two similar compounds, tripropylene glycol and

monopropylene glycol, indicate that oral absorption of dipropylene glycol readily occurs and is extensively metabolized with minor fractions excreted unchanged in urine (ECHA). [Kl. Score =2]

In one study, human cadaver skin indicated that dipropylene glycol is moderately absorbed (~40% of the applied dose) (Fasano et al. 2011 as cited by ECHA). [Kl. Score =1]

C. Acute Toxicity

Oral

In an EPA OPP 81-1 (Acute Oral Toxicity) test, male and female Sprague-Dawley rats were orally gavaged with undiluted dipropylene glycol for a single dose of 5000 milligrams per kilograms body weight (mg/kg-bw). Although some clinical signs of toxicity were observed (e.g., decreased locomotor activity, ataxia) following dosing, no mortality or gross pathological findings upon necropsy were observed after 14 days. Based on this study, a LD50 of >5000 mg/kg-bw is identified for dipropylene glycol (ECHA). [Kl. Score = 1]

Inhalation

In an EPA OPP 81-3 (Acute Inhalation Toxicity) test, male and female Sprague-Dawley rats were exposed to aerosolized dipropylene glycol at a concentration of 2.34 milligrams per litre of air (mg/L) for four hours. During and after 14 days of observation post exposure, no mortality or other clinical findings were observed. Based on this study, an LD50 of >2.34 mg/L (2,340 mg/m^3) is identified for dipropylene glycol (ECHA). [Kl. Score = 1]

Dermal

In an EPA OPP 81-2 (Acute Dermal Toxicity) test, male and female White New Zealand rabbits were dermally exposed for 24 hours to undiluted dipropylene glycol at a concentration of 5010 mg/kg-bw. The skin was observed post exposure and periodically for the following 14 days. No mortality or other clinical findings were observed. Based on this study, an LD50 of >5010 mg/kg-bw is identified for dipropylene glycol (ECHA). [Kl. Score = 1]

D. Irritation

Skin

In an EPA OPP 81-5 (Acute Dermal Irritation) test, male and female White New Zealand rabbits were dermally exposed for 4 hours to 0.5 mL of undiluted dipropylene glycol. The skin was observed post exposure and periodically for 72 hours after patch removal. Scores for both oedema and erythema were zero indicating no skin irritation occurring from exposure to dipropylene glycol in rabbits (ECHA). [Kl. Score = 1]

Two human volunteer studies have been conducted with dipropylene glycol. In one study, a test concentration of 25% in solution with water was applied to 33 male subjects for 24 hours. Mild erythema and mild to moderate oedema were reported for two subjects after 24 hours post exposure. In a second study, 0.2 mL of undiluted and 50% diluted dipropylene glycol were applied in a 14-day cumulative irritation test to the upper back of 26 volunteers. Only one subject had signs of reversible mild oedema during the first four days of exposure (ECHA). [Kl. Score = 2]

Based on these studies in animals and humans, dipropylene glycol does not have skin irritating potential (ECHA).

Eye

In an EPA OPP 84-4 (Acute Eye Irritation) test, 0.1 mL of undiluted dipropylene glycol was applied to one eye of male and female White New Zealand rabbits and clinicals findings recorded 1, 24, 48 and 72 hrs after exposure. At one hour, slight irritation (conjunctival redness) was observed, but after 24 hours and on, all eyes appeared normal. Based on this study, dipropylene glycol is found to be not irritation to the eye (ECHA). [Kl. Score = 1]

E. Sensitisation

In an EPA OPP 81-6 (Skin Sensitisation) test, known as a Buehler test, was conducted on male and female guinea pigs (unspecified strain) for undiluted dipropylene glycol for three 6-hour exposures over the course of 14 days for the induction period. Fourteen days after the induction period study, the animals were challenged again with undiluted dipropylene glycol at another exposure location. No reactions were recorded at 24, 48 and 72 hours post exposure indicating that dipropylene glycol does not warrant a skin sensitisation classification (ECHA). [Kl. Score = 1]

In a human volunteer study, 34 eczema patients were treated with 10% dipropylene glycol over seven months. Patches were applied for two days and then ready at days 2, 3 and 5-7. Only one patient had a definitely positive patch test reaction to dipropylene glycol indicating contact allergy is rare in the general population (Johansen et al. 1995). [Kl. Score = 2]

There are no inhalation sensitisation studies for dipropylene glycol.

F. Repeated Dose Toxicity

Oral

In a two year (105 week) study, male and female Fischer 344 rats were given concentrations of dipropylene glycol with tap water at concentrations of 0.25, 1 and 4 mL. Based on laboratory measurements, these corresponded to dosing regimens of 115 (140), 470 (530) and 3040 (2330) mg/kg-bw for male (female) subjects. At the highest dosing regimen, mortality in males was 100% in addition to liver (increased incidence of bile duct hyperplasia) and nasal (increased incidence of olfactory epithelial degeneration) effects in both males and females. Based on this study, a NOAEL of 470 mg/kg-day is identified for dipropylene glycol (ECHA). [Kl. Score = 2]

Inhalation

No studies available.

Dermal

No studies available.

G. Genotoxicity

Based on the results of the *in vivo* and *in vitro* assays, a classification of genotoxicity for dipropylene glycol is not warranted (ECHA).

In Vitro Studies

The *in vitro* genotoxicity studies on dipropylene glycol are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on Dipropylene Glycol

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
National Institutes of Health (NIH) (Bacterial Reverse Mutation Assay) (*Salmonella typhimurium TA1537, TA1535, TA98, TA100*)	-	-	2	ECHA
OECD Guideline 476 equivalent (*In vitro* Mammalian Cell Gene Mutation Test) (mouse lymphoma cells (L5178Y))	-	-	2	ECHA

*+, positive; -, negative

In Vivo Studies

An OECD Guideline 474 (Mammalian Erythrocyte Micronucleus) test was conducted on male CD-1 mice. Test subjects orally gavage once with a dose of 500, 1000, or 2000 mg/kg-bw dipropylene glycol. After 24 hours, bone marrow cells were collected and evaluated for genotoxicity as frequencies of micronuclei in polychromatic erythrocytes and percent polychromatic erythrocytes. No clinical effects nor any increases in genotoxicity were observed (ECHA). [Kl. Score = 1]

H. Carcinogenicity

Oral

A two-year study in mice and rats evaluated exposure to dipropylene glycol in drinking water at increasing concentrations, including controls. In the first study, Fischer 344 rats ingested doses of 115, 470 and 3040 mg/kg-bw/day for males and 140, 530 and 2300 mg/kg-bw/day for females at the end of the two-year study. Although some non-neoplastic pathological changes were observed, no neoplastic lesions were observed in the tissues examined (adrenal gland, kidney, liver, salivary gland, mammary gland, forestomach). Based on this study, NOAELs of 3040 (males) and 2300 (females) mg/kg-bw/day are identified for dipropylene glycol (ECHA). [Kl. Score = 2]

In the second party of the study, B6C3F1 mice had ingested doses of 735, 1220 and 2390 mg/kg-bw/day for males and 575, 1040 and 1950 mg/kg-bw/day for females at the end of the study. Similar to the rats, neoplastic lesions were not observed in the tissues examined (adrenal gland, lung, liver). (ECHA). [Kl. Score = 2]

Inhalation

No studies available.

Dermal

No studies available.

I. Reproductive Toxicity

A National Toxicology Program (NTP) reproductive assessment by continuous breeding (RABC) test was conducted on male and female CD-1 mice over two generations. The ingested doses for each group were 1820, 4800, and 10100 mg/kg-bw/day based on continuous concentrations of

dipropylene glycol in drinking water. Neither parental nor offspring (F1 and F2) generations had effects on mating index or differences on control and test animals for any reproductive outcome measured (e.g., number of offspring, number of liver offspring, etc). Based on this study, a NOAEL for reproductive effects of 10100 mg/kg-bw/day is identified for dipropylene glycol (Morrissey et al. 1989 as cited by ECHA). [Kl. Score = 2]

J. Developmental Toxicity

An OECD Guideline 414 (Prenatal Developmental Toxicity Study) for dipropylene glycol, was conducted on female New Zealand White rabbits. Test subjects were orally gavaged with dipropylene glycol and water at 200, 400, 800 and 1200 mg/kg-bw daily from gestation day 6 to day 19. At the end of the observation period, no adverse maternal or developmental toxicity observations were recorded as treatment related or different from the control group. Based on this study, a NOAEL of 1200 mg/kg-bw/day for developmental effects is identified for dipropylene glycol (ECHA). [Kl. Score = 1]

An OECD Guideline 414 test (Prenatal Developmental Toxicity Study) was conducted on male and female Sprague-Dawley rats. Test subjects were orally gavaged with dipropylene glycol and water at 800, 2000, and 5000 mg/kg-bw daily from gestation day 6 to day 15. At the end of the observation period, although some maternal toxicity was observed (NOAEL = 800 mg/kg-bw-day), no developmental toxicity observations were recorded as treatment related or different from the control group. Based on this study, a NOAEL of 2000 mg/kg-bw/day for developmental effects is identified for dipropylene glycol (ECHA). [Kl. Score = 1]

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for dipropylene glycol follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

A chronic study of dipropylene glycol in drinking water in rat identified a NOAEL of 470 mg/kg-bw for male rats. The NOAEL from this study is based on no effect for mortality and effects to the liver and nasal tissues. This NOAEL will be used to derive an oral reference dose and drinking water guideline value for dipropylene glycol.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 1
UF_D (database uncertainty) = 1
Oral RfD = 470/(10 x 10 x 1 x 1 x 1) = 470/100 = 4.7 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (4.7 x 70 x 0.1)/2 = 16.5 mg/L

B. Cancer

There was no evidence of carcinogenicity in rat and mouse chronic studies conducted on dipropylene glycol indicating a low concern for carcinogenicity. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Dipropylene glycol does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Dipropylene glycol is expected to have low acute and chronic toxicity to aquatic organisms. Dipropylene glycol is expected to have low acute toxicity for terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of experimental and predicted acute aquatic toxicity studies conducted on dipropylene glycol.

Table 3: Acute Aquatic Toxicity Studies on Dipropylene Glycol

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Pimephales promelas (Fathead minnow fish)	96-hr LC_{50}	46,500 (read across monopropylene glycol, CAS RN 57-55-6)	2	ECHA

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Oryzias latipes (Japanese rice fish)	96-hr LC_{50}	>1,000 (read across tripropylene glycol, CAS RN 24800-44-0)	2	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	>100	1	ECHA
Desmodesmus subspicatus (Green algae)	72-hr EC_{50}	>100 (growth)	1	ECHA

Chronic Studies

Table 4 lists the results of experimental and predicted chronic aquatic toxicity studies conducted on dipropylene glycol.

Table 4: Chronic Aquatic Toxicity Studies on Dipropylene Glycol

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Fish	30-day ChV	1,340 (QSAR)	2	ECHA
Daphnia magna	16-day ChV	466 (QSAR)	2	ECHA
Desmodesmus subspicatus (Green algae)	72-hr NOEC	>100 (growth)	1	ECHA

Note: ChV = chronic value, defined as the geometric mean of the NOEC and LOEC

C. Terrestrial Toxicity

A 14-day study administered doses of 0 and 2,000 mg/kg to *Colinus virginianus* (Northern bobwhite bird). The study identified an LD50 of >2,000 mg/kg dw (ECHA) [Kl. Score = 2].

D. Calculation of PNEC

The PNEC calculations for dipropylene glycol follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (>1,000 mg/L), invertebrates (>100 mg/L), and algae (>100 mg/L). NOEC values from long-term studies are available for fish (1,340 mg/L), invertebrates (466 mg/L) and algae (>100 mg/L). On the basis that the data consists of short-term and long-term results from three trophic levels, an assessment factor of 10 has been applied to the lowest reported NOEC value of 100 mg/L for algae. The $PNEC_{water}$ is 10 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 7.2 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
= (0.916/1280) x 1000 x 10
= 7.2 mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
= 0.8 + [(0.2 x 0.2416/1000 x 2400]
= 0.916 m^3/m^3

Where:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
= 6.04 x 0.04
= 0.2416 L/kg

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for dipropylene glycol calculated from EPISUITE™ using the MCI is 6.04 L/kg.
F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are limited toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 0.81 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
= (0.1208/1500) x 1000 x 10
= 0.81 mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
$Kp_{soil} = K_{oc} \times f_{oc}$
= 6.04 x 0.02
= 0.1208 m^3/m^3

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for dipropylene glycol calculated from EPISUITE™ using the MCI is 6.04 L/kg.

F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Dipropylene glycol is readily biodegradable and thus does not meet the screening criteria for persistence.

No data are available on bioaccumulation. However, based on the log K_{ow} of -0.46 L/Kg, bioaccumulation is not expected. Thus, dipropylene glycol does not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on dipropylene glycol are > 0.1 mg/L. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies on dipropylene glycol are > 1 mg/L. Thus, dipropylene glycol does not meet the criteria for toxicity.

The overall conclusion is that dipropylene glycol is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

None

B. Labelling

None

C. Pictogram

None

X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses if easily possible.

Skin Contact

Remove contaminated clothes. Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person. Do not induce vomiting.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical. Water or foam may cause frothing but are still acceptable media.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice. Avoid breathing vapours, mist or gas. Any clothing that may have been contaminated, put into a vapour-tight plastic bag for eventual disposal.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed. For small spills, wash any surfaces that may have been contaminated with a soap and water solution.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Chemical should be stored under refrigerated temperatures and kept away from oxidizing materials.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard for dipropylene glycol in Australia is not available.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Dipropylene glycol is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

Australian Drinking Water Guidelines [ADWG]. (2011). National Water Quality Management Strategy. Australian Drinking Water Guidelines, Section 6, Australian Government, National Health and Medical Research Council, Natural Resource Management Ministerial Council. Updated June 2025. https://www.nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines

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DIUTAN (CAS RN 595585-15-2)
DIUTAN GUM (CAS RN 125005-87-0)
WELAN GUM (CAS RN 72121-88-1)

This group contains similar water-soluble carbohydrate polymers. They are expected to have similar environmental concerns and have consequently been assessed as a group. Diutan (CAS RN 595585-15-2) can also be referred to as diutan gum (CAS RN 125005-87-0). Information provided in this dossier is based on diutan gum (CAS RN 125005-87-0).

This dossier on diutan, diutan gum and welan gum presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained for diutan gum from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Diutan, diutan gum and welan gum are classified as **tier 1** chemicals and requires a hazard assessment only.

1 BACKGROUND

Diutan/Diutan gum and welan gum are natural high-molecular-weight gums produced by carefully controlled aerobic fermentation. The repeating unit is composed of a six-sugar unit. The backbone is made up of d-glucose, d-glucuronic acid, d-glucose, and l-rhamnose, and the side chain of two l-rhamnose. When added to cement grouts, these polymers exhibit a shear-thinning behaviour. At low shear rates, the grout shows a high apparent viscosity resulting from entanglement and intertwining of the polymer, whereas at high shear rates the viscosity decreases because of the alignment of the polymer along the direction of the flow, thus enhancing fluidity.

Diutan/diutan gum and welan gum are readily biodegradable, are not expected to bioaccumulate, and have a low potential to adsorb to soil. Diutan/diutan gum and welan gum are of low acute toxicity concern to aquatic organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Names (IUPAC): (2R,3R,4S,5S)-2,3,4,5-tetrahydroxyhexanal (2R,3S,4R,5R)-2,3,4,5,6-pentahydroxyhexanal (2S,3S,4S,5R)-2,3,4,5-tetrahydroxy-6-oxohexanoic acid acetic acid calcium dihydride hydrate magnesium dihydride potassium hydride sodium hydride

CAS RN: 125005-87-0

Molecular formula: $C_{20}H_{46}CaKMgNaO_{21}$

Molecular weight: Not applicable as substance is a UVCB.

Synonyms: Diutan gum; S 657; S-657 Gum; GEOVIS XT; GEOVIS XTL; KELCO-CRETE DG

Chemical Name (IUPAC): D-glucuronic acid, polymer with 6-deoxy L-mannose and D-glucose, acetate, Ca Mg K Na salt

CAS RN: 595585-15-2

Molecular formula: $(C_6H_{12}O_6.\ C_6H_{12}O_5.\ C_6H_{10}O_7)x.C_2H_4O_2.\ xCa.xK.xMg.xNa$

Molecular weight: Not applicable as substance is a UVCB.

Synonyms: Diutan; D-Glucurono-D-gluco-6-deoxy-L-mannan, acetate, calcium magnesium potassium sodium salt

Chemical Name (IUPAC): D-glucopyranuronic acid, polymer with 6-deoxy-L-mannose, D-glucose and D-mannose, calcium potassium sodium salt

CAS RN: : 72121-88-1

Molecular formula: $(C_6H_{12}O_6.C_6H_{12}O_6.C_6H_{12}O_5.C_6H_{10}O_7)_x.xCa.xK.xNa$

Molecular weight: Not applicable as substance is a UVCB

Synonyms: Welan gum; D-glucose, polymer with 6-deoxy-L-mannose, D-glucopyranuronic acid and D-mannose, calcium potassium sodium salt; L-mannose, 6-deoxy-, polymer with D-glucopyranuronic acid, D-glucose and D-mannose, calcium potassium sodium salt; S-130; Biozan

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for diutan gum are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Diutan Gum (CAS RN. 125005-87-0)

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Off white solid powder	1	ECHA
Melting Point	No melting point was determined. Test substance decomposed at >175°C.	1	ECHA
Boiling Point	No data	-	-
Density	1430 Kg/m^3 @ 20°C	1	ECHA
Vapor Pressure	~0.1 kPa @ 25°C	-	NICNAS, 2010
Partition Coefficient (log K_{ow})	-3.56 @ 20°C	2	ECHA
Dissociation Constant (pKa)	Not relevant	-	ECHA
Water Solubility	40 g/L @ 20°C	2	ECHA
Viscosity	Not applicable, substance is a solid	-	-

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for diutan, diutan gum or welan gum.

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Diutan/diutan gum and welan gum are readily biodegradable, not expected to bioaccumulate, and have a low potential to adsorb to soil.

B. Biodegradation

A GLP-compliant study conducted in accordance with OECD guideline was available. The test material (diutan gum) attained 95% degradation after 28 days and satisfied the 10-day window validation criterion, whereby 60% degradation must be attained within 10 days of the degradation rate exceeding 10%. The test material is considered to be readily biodegradable under strict terms and conditions of the OECD guideline 301B. [Kl. Score = 1] (ECHA).

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

No experimental data are available for diutan/diutan gum. Based on the low experimentally determined log K_{ow} (-3.56) value, the substance has a low potential to adsorb to soil and will be highly mobile in soil.

D. Bioaccumulation

No experimental data are available for diutan/diutan gum. Based on the low log K_{ow} (-3.56), the potential for bioaccumulation is low.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Diutan, diutan gum and welan gum is of low acute toxicity concern to aquatic organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 presents the results of acute aquatic toxicity studies on diutan/diutan gum. No data is available for welan gum, but similar toxicity as diutan/diutan gum is expected.

Table 3 Acute Aquatic Toxicity Studies on Diutan Gum

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Oncorhynchus mykiss (Rainbow Trout)	96-h LC_{50}	>100	1	ECHA
Daphnia magna	48-h LC_{50}	>100	1	ECHA
Desmodesmus subspicatus (previous name: *Scenedesmus subspicatus*)	72-h EC_{50}	>100 (growth rate)	1	ECHA

Chronic Studies

No data are available.

C. Terrestrial Toxicity

No data are available.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Diutan/diutan gum and welan gum is readily biodegradable; thus, they do not meet the screening criteria for persistence.

Bioaccumulation of diutan/diutan gum and welan gum is not expected to occur based on its log K_{ow} value of -3.56 . Thus, diutan/diutan gum and welan gum do not meet the screening criteria for bioaccumulation.

No chronic toxicity data is available. The $E(L)C_{50}$ values from the acute aquatic toxicity studies on diutan/diutan gum are >1 mg/L. Thus, diutan/diutan gum and welan gum do not meet the criteria for toxicity.

Therefore, diutan/diutan gum and welan gum are not PBT substances.

B. Other Characteristics of Concern

No other characteristics of concern were identified for diutan/diutan gum and welan gum.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Diutan	595585-15-2	Not a PBT	No	No	No	No	No	No	1	No data	1
Diutan Gum	125005-87-0	Not a PBT	No	No	No	No	No	No	1	No data	1
Welan Gum	72121-88-1	Not a PBT	No	No	No	No	No	No	1	No data	1

Footnotes:

1 – PBT Assessment based on PBT Framework.

2 – Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

Department of the Environment and Energy [DoEE]. (2017). *Chemical Risk Assessment Guidance Manual: for chemicals associated with coal seam gas extraction*. Guidance manual prepared by Hydrobiology and ToxConsult Pty Ltd for the Department of the Environment and Energy, Commonwealth of Australia, Canberra. https://www.dcceew.gov.au/water/coal-and-coal-seam-gas/national-assessment-chemicals/consultation-risk-assessment-guidance-manual

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/cm^3	grams per cubic centimetre
GLP	Good Laboratory Practice
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
Kl	Klimisch
kPa	kilopascal
LC	lethal concentration

mg/L	milligrams per litre
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NOEC	no observed effect concentration
OECD	Organisation for Economic Co-operation and Development
Pa	pascal
PBT	Persistent Bioaccumulative Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
UVCB	Unknown or Variable Composition, Complex Reaction Products and Biological Materials

ETHYLENE OXIDE/PROPYLENE OXIDE COPOLYMER (CAS RN 9003-11-6)
ETHYLENE OXIDE/PROPYLENE OXIDE COPOLYMER (CAS RN 9082-00-2)

This dossier on ethylene oxide/propylene oxide copolymer (EO/PO copolymer) presents the most critical studies pertinent to the risk assessment of EO/PO copolymer in its use in coal seam gas extraction activities. It does not represent an exhaustive or critical review of all available data. Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – EO/PO copolymer is a polymer of low concern. Therefore, it is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

EO/PO copolymer is a group of polymers that can vary in molecular weight (size). They are non-volatile and vary in water solubility. EO/PO copolymers are either readily biodegradable or inherently biodegradable and are not expected to bioaccumulate. EO/PO copolymers are practically acutely non-toxic to aquatic organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Oxirane, methyl-, polymer with oxirane

CAS RN: 9003-11-6

Molecular formula: $(C_3H_6O.C_2H_4O)_x$-

Molecular weight: Variable

Synonyms: ethylene oxide, propylene oxide block polymer; poloxalene; poloxamer; polyethylene glycol, propoxylated; polyethylene-polypropylene glycol; polyoxyethylene-oxy-propylene; oxirane, 2-methyl-, polymer with oxirane; oxirane, methyl-, polymer with oxirane

Chemical Name (IUPAC): Oxirane, methyl-, polymer with oxirane, ether with 1,2,3-propanetriol (3:1)

CAS RN: 9082-00-2

Molecular formula: $C_3H_8O_3.3(C_3H_6O.C_2H_4O)_x$-

Molecular weight: Variable

Synonyms: Ethylene oxide-propylene oxide copolymer ether with glycerol (3:1); ethylene oxide-propylene oxide copolymer glycerol ether; glycerol, ethylene oxide, propylene oxide polymer; glycerol poly(oxyethylene, oxypropylene) ether; propylene oxide ethylene oxide polymer, ether with glycerol (3:1); glycerol, propylene oxide, ethylene oxide polymer

3 PHYSICO-CHEMICAL PROPERTIES

The physico-chemical properties of the EO/PO copolymers are listed in Table 1.

Table 1 Overview of the Physico-chemical Properties of Selected EO/PO Copolymers (CIR, 2008)

Properties	Poloxamer 124	Poloxamer 188	Poloxamer 407
Avg. molecular weight (g/mol)	2090-2360	7680-9510	9840-14600
Description	Colourless liquid	White solid	Solid
Wt. % oxyethylene	46.7 ± 1.9	81.8 ± 1.9	73.2 ± 1.7
Melting point (°C)	16	52	56
Solubility	Soluble in water	Soluble in water	Soluble in water

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for EO/PO copolymer.

NICNAS has assessed poloxalene (CAS RN 9003-11-6) in an Inventory Multi-tiered Assessment and Prioritisation (IMAP)Tier 1 assessment and considers it a polymer of low concern[1] .

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

[1] https://www.industrialchemicals.gov.au/help-and-guides/polymer-low-concern-plc-criteria

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

No studies are available.

The following information is from the Dow Chemical Company's Product Safety Assessment document on their EO/PO copolymer products with CAS RN 9003-11-6 and 53637-25-5 (Dow, 2014):

"Polyglycol EP Series Polymers are non-volatile (do not evaporate) and vary in water solubility. If released to water or soil, they would tend to remain in and be transported with the surface or ground water to which they are emitted and will be adsorbed to soil and sediment particles. Polyglycol EP Series Polymers are unlikely to persist in the environment, as all products are known or expected to be either readily biodegradable (>65% biodegraded in 28 days per OECD 301F test) or inherently biodegradable according to Organisation for Economic and Co-operation and Development (OECD) test guidelines. As such, these products will be efficiently removed during treatment in biological wastewater-treatment facilities."

"These products are not expected to accumulate in the food chain (low bioconcentration potential)."

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Aquatic Toxicity

No studies are available.

The following information is from the Dow Chemical Company's Product Safety Assessment document on their EO/PO copolymer products with CAS RN 9003-11-6 and 53637-25-5 (Dow, 2014):

"[EO/PO copolymers] are practically non-toxic to aquatic organisms (LC_{50}/EC_{50} >100 mg/L for the most sensitive species tested) on an acute basis."

B. Terrestrial Toxicity

No studies are available.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

EO/PO copolymers are either readily biodegradable or inherently biodegradable; thus, they do not meet the screening criteria for persistence.

EO/PO copolymers are expected to have high molecular weights and are not expected to be bioavailable. Thus, these copolymers do not meet the criteria for bioaccumulation.

There are no chronic aquatic toxicity studies on the EO/PO copolymers. However, the acute EC_{50} on these copolymers are >1 mg/L in aquatic organisms based on information from Dow Chemical's Product Safety Assessment (Dow, 2014). EO/PO copolymers also have a high molecular weight and are not expected to be bioavailable. Thus, they do not meet the screening criteria for toxicity.

The overall conclusion is that EO/PO copolymers are not PBT substances.

B. Other Characteristics of Concern

No other characteristics of concern were identified for EO/PO copolymer.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
EO/PO Copolymer	9003-11-6	Not a PBT	No	Yes	No	No	No	No	1	1	1
EO/PO Copolymer	9082-00-2	Not a PBT	No	No	No	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

Cosmetic Ingredient Review [CIR]. (2008). Safety Assessment of Poloxamers 101, 105, 108, 122, 123, 124, 181, 182, 183, 184, 185, 188, 212, 215, 217, 231, 234, 235, 237, 238, 282, 284, 288, 331, 333, 334, 334, 338, 401, 402, 403, and 407, Poloxamer 105 benzoate, and Poloxamer 182 dibenzoate as used in cosmetcs. *Int. J. Toxicol. 27 (Supppl. 2)*: 93–128.

Dow Chemical Company [Dow]. (2014, June 5). Product Safety Assessment from Dow Chemical Company on their Polyglycol EP Series Polymers/FLUENT Brand Polyglycols/SYNALOX™ Fluids. Revised June 5, 2014.

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Industrial Chemicals Environmental Management Standard [IChEMS]. (2022). Australian Environmental Criteria for Persistent, Bioaccumulative and/or Toxic Chemicals. https://www.dcceew.gov.au/sites/default/files/documents/australian-pbt-criteria.pdf

Klimisch, H.J., Andreae, M., and Tillmann, U. (1997). A systematic approach for evaluating the quality of experimental and toxicological and ecotoxicological data. *Regul. Toxicol, Pharmacol. 25*:1–5.

B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
EC	effective concentration
ECHA	European Chemicals Agency
EO/PO	ethylene oxide/propylene oxide
EU	European Union
IChEMS	Industrial Chemicals Environmental Management Standard
IMAP	Inventory Multitiered Assessment and Prioritisation
IUPAC	International Union of Pure and Applied Chemistry
LC	lethal concentration
mg/L	milligrams per litre
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
OECD	Organisation for Economic Co-operation and Development
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases

EPICHLOROHYDRIN

This dossier on epichlorohydrin presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed epichlorohydrin in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to the environment.[1]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): 2-(chloromethyl)oxirane

CAS RN: 106-89-8

Molecular formula: C_3H_5ClO

Molecular weight: 92.52 g/mol

Synonyms: epichlorohydrin; ECH; Propane, 1-chloro-2,3-epoxy-

SMILES: ClCC1CO1

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of Epichlorohydrin

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Colourless Liquid. Pungent odour.	2	ECHA
Melting Point	-57.1°C @ 101.3 kPa	2	ECHA
Boiling Point	117°C @ 101.3 kPa	2	ECHA
Density	1180 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	2280 Pa @ 25°C	2	ECHA
Partition Coefficient (log K_{ow})	0.45 @ 20°C	2	ECHA
Water Solubility	65.9 g/L @ 20°C	2	ECHA
Flash Point	40.05°C	2	ECHA
Auto flammability	385.05°C	2	ECHA

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=da86433e-f36b-1410-8c14-0026b2c59b62

Property	Value	Klimisch Score	Reference
Viscosity	1.037 mPa s @ 20°C	2	ECHA
Henry's Law Constant	Not available	-	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Epichlorohydrin is rapidly biodegradable. It is not expected to bioaccumulate. It is expected to have mobility in soil, and it is not expected to adsorb to soil or sediment.

B. Biodegradation

Epichlorohydrin is rapidly biodegradable based on the degradation of its hydrolysis product (ECHA). In an aerobic study with sludge evaluating the degradation product 3-chloro-1,2-propylene glycol, there was 68% degradation based on oxygen consumption and 84.3% degradation based on removal of total organic carbon after 14 days (ECHA) [Kl.. Score = 1].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

Based on a predicted K_{oc} values of 4.48 L/kg (CESAR) and 40 L/kg (NCBI, 2026), epichlorohydrin is expected to have high mobility in soil and it is not expected to strongly adsorb to soil or sediment. If released to water, based on this K_{oc} value and its water solubility, it is expected to preferentially partition to the water column. Volatilisation from water may be superseded by rapid hydrolysis. Epichlorohydrin hydrolyses in distilled water to yield 1-chloro-2,3-propanediol, with a half-life of 8.2 days (NCBI, 2026).

D. Bioaccumulation

No bioaccumulation studies are available. Based on a log K_{ow} of 0.45 (ECHA), epichlorohydrin has a low potential for bioaccumulation (ECHA)

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Epichlorohydrin is noted to be a low systemic hazard from acute/short term exposures. It is corrosive to both the skin and eyes and is a skin sensitiser. Based on the data available, epichlorohydrin may have some localised and systemic effects from repeated exposures to high concentrations from oral and inhalation exposures. Epichlorohydrin has been identified as genotoxic in both *in vitro* and *in vivo* studies and is likely to be mutagenic and/or carcinogenic to humans. In animal studies, exposures to epichlorohydrin may lead to some reproductive effects in males but is not reported to be developmentally toxic via inhalation.

B. Metabolism

Epichlorohydrin is moderately (~50%) absorbed through both the gastrointestinal tract and through dermal exposures and is rapidly metabolized. Little data are available for absorption and toxicokinetics via inhalation exposures. An OECD Guideline 417 (Toxicokinetics) test was conducted for epichlorohydrin in Fischer 344 rats from a single dose of 6 milligrams per kilogram body weight (mg/kg-bw) delivered via oral gavage. Test subjects were kept in a glass metabolism cage for 72 hours post-dosing to assess metabolites in excreta and expired air.

Approximately 38% of the dose was exhaled as carbon dioxide (CO_2), 50% excrete in the urine, and 3% in faeces. About 4% of the dose is excreted in the urine as unchanged epichlorohydrin and about 36% of as the metabolite N-acetyl-S-(3-chloro-2-hydropropyl)-L-cysteine. This is consistent with the initial metabolic reaction of conjugation of an epoxide with glutathione followed by hydration of the epoxide (ECHA). [Kl. Score = 2]

C. Acute Toxicity

Oral

An EPA OPP 81-1 (Acute Oral Toxicity) test was conducted on males and females of two strains of rats, Sprague-Dawley and Fischer 344). Test subjects were orally gavaged with a single dose of undiluted epichlorohydrin at varying concentrations and observed for two weeks. Mortality was observed at doses starting at 200 and 210 mg/kg-bw per day for females and males, respectively. Based on this study, the oral LD50 for epichlorohydrin is identified as a range of 175-282 mg/kg-bw/day (ECHA). [Kl. Score = 2]

Inhalation

A 1-hr LC50 test was conducted on male and female Sprague-Dawley rats were exposed to unchanged epichlorohydrin vapour at varying concentrations up to 4609 parts per million (ppm) for females and 3275 ppm for males. During and after 14 days of observation post exposure, 100% mortality occurred in rats at 3995 ppm (females only) with no mortality (males and females) observed at 3275 ppm. Based on this study, an estimated LC50 of 3610 ppm is identified for epichlorohydrin (ECHA). [Kl. Score =2]

Dermal

A dermal LD50 test was conducted on male and female White New Zealand rabbits exposed for 24 hours to either undiluted epichlorohydrin at concentrations of 100, 200, 465, and 795 mg/kg-bw (2 rabbits per dose) or a 20% solution of epichlorohydrin in propylene glycol at doses of 252, 500, 630 and 795 mg/kg-bw. Skin was observed post exposure and periodically for 14 days following. All rabbits exposed to 795 mg/kg-bw undiluted epichlorohydrin died within 24 hours and similarly at the 500 mg/kg-bw of diluted epichlorohydrin. Based on this study, an LD50 of 515 mg/kg-bw is identified for epichlorohydrin and between 250-510 mg/kg-bw for the epichlorohydrin/propylene glycol mixture (ECHA). [Kl. Score = 2]

D. Irritation

Skin

In a Draize and Woodward test, male and female rabbits (unspecified strain) were dermally exposed to undiluted epichlorohydrin for either 2 (at 0.1 to 0.2 mL) or 24 hrs (0.5 mL). The skin was observed

for 30 days post exposure. In both dosing regimens, necrotic lesions were observed with more severe responses in the group exposed for 24 hrs. Following the 30-day observation period, healing was noted both clinically and histopathologically during necropsy. Based on this study, epichlorohydrin is classified as Category 1 (corrosive) for skin (ECHA). [Kl. Score = 2]

Eye

In a study in rabbits (strain, sex and other parameters unknown), 0.001 mL of epichlorohydrin, either undiluted or in concentrations of 0.1 and 0.01% in water was ocularly applied for 24 hours and observations recorded post exposure. After 24 hours, severe necrosis was observed in the rabbits treated with undiluted epichlorohydrin while some necrosis was observed for the 0.1% solution and no necrosis for rabbits exposed to the 0.01% solution. Based on this study, epichlorohydrin is classified as Category 1 (irreversible effects on the eye) (ECHA). [Kl. Score = 2]

E. Sensitisation

In an OECD Guideline 406 (Skin Sensitization) test, 15 female Hartley guinea pigs were treated with a topical application and intradermal injection of 5% epichlorohydrin in the induction phase followed two weeks later by one application of 1% epichlorohydrin to test for sensitization. Nine of 15 test subjects showed a sensitisation effect after exposure to epichlorohydrin during the challenge phase. Based on this study, epichlorohydrin is classified as Category 1 (skin sensitising) (ECHA). [Kl. Score = 2]

F. Repeated Dose Toxicity

Oral

An OECD Guideline 408 (Repeated Dose 90-Day Oral Toxicity Study in Rodents) test was conducted on ten male and ten female Sprague-Dawley rats orally gavaged with epichlorohydrin. Doses were administered at 3, 7, 19 and 46 mg/kg-bw/day in one group for 10 days and at 1, 5 and 25 mg/kg-bw/day for 90 consecutive days. In the group dosed for 90 days, a no observed adverse effect level (NOAEL) of 1 mg/kg-bw/day is identified based on histopathological changes to the forestomach (as hyperplasia and hyperkeratosis) in both the 5 and 25 mg/kg-bw/day dosing group. Similar effects in the forestomach were also observed in the group exposed for 10 days at all doses (LOAEL = 3 mg/kg-bw/day). Based on this study, a NOAEL of 1 mg/kg-day is identified for epichlorohydrin (ECHA). [Kl. Score = 1]

Inhalation

An OECD Guideline 413 (Subchronic Inhalation Toxicity: 90-Day Study) test was conducted on two species; Fisher 344 and Sprague-Dawley rats and B6C3F1 mice. For each species and strain, twenty animals per sex were exposed for 6 hr/day, 5 days/week for 12 weeks for a total of 87 days to epichlorohydrin vapour at concentrations of 5, 25, and 50 ppm. At 25 and 50 ppm, clinical effects were observed, mostly notably in histopathological changes to the nasal epithelium. In the group exposed to 5 ppm, these effects, as well as other endpoints (mortality, clinical chemistry and observations, body/organ weight, urinalysis, haematological effects as well as gross and histopathological findings) were not observed. Based on this study, a NOAEL of 5 ppm was identified for epichlorohydrin in air (ECHA). [Kl. Score = 1].

Dermal

No studies available.

G. Genotoxicity

Based on these two studies, epichlorohydrin is identified as genotoxic from both *in vitro* and *in vivo* studies with inhalation exposure producing less genotoxic effects compared to oral exposure.

In Vitro Studies

The *in vitro* genotoxicity studies on epichlorohydrin are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on epichlorohydrin

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay) (*Salmonella typhimurium* TA1535 and TA100)	+	+	2	ECHA
OECD Guideline 471 (Bacterial Reverse Mutation Assay) (*Salmonella typhimurium* TA1535 and TA100)	+	N/A	2	ECHA
OECD Guideline 476 equivalent (*In vitro* Mammalian Cell Gene Mutation Test) (mouse lymphoma L5178Y cells)	+	N/A	2	ECHA

*+, positive; -, negative, N/A – not applicable

In Vivo Studies

An OECD Guideline 475 (Mammalian Bone Marrow Chromosome Aberration) test was conducted on female ICR mice orally gavaged with epichlorohydrin either as a single dose (5, 20, 40 and 100 mg/kg) or for five daily doses of 20 mg/kg. Additional mice were administered epichlorohydrin intraperitoneally for a single dose (1, 3, 5, 10, 20 and 40 mg/kg) or for five daily doses of 5, 10 or 20 mg/kg. Mice were sacrificed after 6, 24 or 48 hours after the single dose treatment or six hours after the last treatment in the repeated dose groups.

Both treatment regiments (single and repeated doses) resulted in an observed dose-effect frequency of changes of abnormal cells indicating a positive response.

A second simultaneous OECD Guideline 475 study was conducted on male and female Fischer 344 rats exposed via inhalation to epichlorohydrin vapour at 5, 25 and 50 ppm for 6 hrs a day, 5 days/week for 4 weeks. Compared to the oral gavage study, chromosomal aberrations were observed but without a consistent dose-response effect.

H. Carcinogenicity

Oral

The IARC has concluded that epichlorohydrin is Group 2A "probably carcinogenic to humans" based on human and animal studies (IARC 1999) and the National Toxicology Program identified epichlorohydrin as "reasonably anticipated to be a human carcinogen" (NTP 2021). Both agencies conclude that while animal studies have shown carcinogenic potential, human epidemiological studies have found some weak associations with respiratory cancers, but the data from these studies are inadequate to conclusively determine carcinogenicity.

An OECD Guideline 451 (Carcinogenicity Studies) test was conducted on male and female rats orally gavaged with epichlorohydrin in distilled water at 2 or 10 mg/kg-bw/day for five days/week for 2 years. At 10 mg/kg-bw/day, mortality and decreases in weight gain were observed in male rats. Tumour incidence, in particular squamous cell carcinomas in the forestomach, were observed in 100% of females and 81% of males in the 10 mg/kg-bw/day group and with less frequency in the 2 mg/kg-bw/day group at 7% and 14% for females and males, respectively. Based on this study, epichlorohydrin is considered to be a locally acting carcinogen with a LOAEL of 2 mg/kg-bw/day (ECHA). [Kl. Score = 2]

Inhalation

In an inhalation study of carcinogenicity, male Sprague-Dawley rats were exposed to epichlorohydrin vapour for 5 hrs/day, 6 days/week for six weeks at a concentration of 100 ppm or for two years at 10 or 30 ppm. At the end of two years, both groups were evaluated for tumour incidence. In the animals exposed for the entire two years, 1 malignant squamous cell carcinoma of the nasal cavity and 1 nasal papilloma were observed. However, in the higher concentration, limited exposure group, tumour incidence was more than ten times higher with 15 squamous cell carcinomas observed. Based on this study, epichlorohydrin is considered a carcinogen by the inhalation route with a LOAEC of 113 milligrams per cubic meter in air (mg/m^3) (ECHA). [Kl. Score = 2]

Dermal

No studies available.

I. Reproductive Toxicity

Oral

A reproductive toxicity study was conducted on male and female Long-Evans rats orally gavaged with epichlorohydrin in corn oil at doses of 12.5, 25 and 50 mg/kg-bw/day for males and 25, 50 and 100 mg/kg-bw/day for females for 14 and 21 days, respectively. Treated animals were mated with untreated animals with females receiving continued treatment through delivery. Fertility parameters in females were not different from controls in any dosing group, however, males exhibited dose-dependent changes to all sperm mobility parameters beginning with the lowest dose of 12.5 mg/kg-bw/day. Based on this study, a LOAEL for reproductive effects (sperm motion parameters) of 12.5 mg/kg-bw/day is identified for epichlorohydrin (ECHA). [Kl. Score = 2]

Inhalation

In one inhalation reproductive toxicity study, male and female Sprague-Dawley rats were exposed to epichlorohydrin vapour at concentrations of 5, 25 and 50 ppm for 6 hrs/day, 5 days/week for 10 weeks and observed post exposure for 10 additional weeks with fertility evaluated after 2, 4, 7 and 10 weeks post exposure. Treated animals were mated with untreated animals. Female fertility was not affected by exposure to epichlorohydrin, however, males exposed to 25 and 50 ppm had transient infertility but was reversed two weeks after exposure ended. No adverse effects were observed in the 5 ppm dosed males. Based on this study, a no observed adverse effect concentration (NOAEC) of 5 ppm is identified for epichlorohydrin based on transient effects on male fertility (ECHA). [Kl. Score = 2]

In a second inhalation study, male New Zealand White rabbits were exposed to epichlorohydrin vapour at concentrations of 5, 25 and 50 ppm for 6 hrs/day, 5 days/week for 10 weeks and observed for 10 weeks post exposure. Treated males were mated with untreated females in addition to have

sperm evaluated for volume, motility, viability, concentration and fertility of spermatozoa. No discernible effects were observed and no differences in fertility were observed. Based on this study, a NOAEC of 50 ppm is identified for epichlorohydrin (ECHA). [Kl. Score = 2]

J. Developmental Toxicity

OECD Guideline 414 (Prenatal Developmental Toxicity) tests for inhalation of epichlorohydrin vapours have been conducted on two different species, rats and rabbits. In one study, pregnant Sprague-Dawley rats were exposed to concentrations of 2.5 and 25 ppm for 7 hrs/day on days 6 through 15 of gestation. Although some maternal effects (decrease food consumption and body weight gain) were observed at 25 ppm, no developmental, teratogenic or embryonic effects were observed in the study (ECHA). [Kl. Score = 2]

In the second part of the OECD Guideline 414, pregnant New Zealand White rabbits were similarly exposed to 2.5 and 25 ppm epichlorohydrin vapour for 7 hrs/day on days 6 through 18 of gestation. Unlike the rat study, neither maternal nor developmental/teratogenic/embryonic effects were observed in the study at either test concentration (ECHA). [Kl. Score = 2]

Based on these two studies, a NOAEC of >25 ppm is identified for developmental effects of epichlorohydrin.

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for epichlorohydrin follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

An oral reference dose was not derived for epichlorohydrin. The Australian drinking water guideline values (ADWG) of 0.0005 mg/L may be applicable (ADWG, 2011). This health-based guideline value was based on a LOEL of 2 mg/kg bw/day determined in a 2-year gavage study using rats with an uncertainty factor of 10,000 (10 for interspecies variations, 10 for intraspecies variations, 10 for using a LOEL instead of a NOEL and 10 for carcinogenic effects).

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Epichlorohydrin does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Epichlorohydrin is expected to have low acute and chronic toxicity to aquatic organisms. No studies are available for terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Aquatic toxicity testing is complicated by reactivity of epichlorohydrin and its instability in aquatic environments. The rate of elimination of epichlorohydrin from environmental waters is mainly determined by both evaporation and hydrolysis (ECHA).

Table 3 lists the results of acute aquatic toxicity studies conducted on epichlorohydrin.

Table 3: Acute Aquatic Toxicity Studies on Epichlorohydrin

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Pimephales promelas (Fathead minnow fish)	96-hr LC_{50}	10.6	2	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	23.9 (geometric mean)	2	ECHA
Raphidocelis subcapitata (formerly Pseudokirchnerella subcapitata) (Green algae)	72-hr ErC_{50}	15 (growth)	1	ECHA

Chronic Studies

No chronic studies are available.

C. Terrestrial Toxicity

No studies available.

D. Calculation of PNEC

The PNEC calculations for epichlorohydrin follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (10.6 mg/L), invertebrates (23.9 mg/L), and algae (15 mg/L). No chronic studies are available. On the basis that the data consists of short-term results from three trophic levels, an assessment factor of 100 has been applied to the lowest reported E(L)C_{50} value of 10.6 mg/L for fish. The $PNEC_{water}$ is 0.106 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 0.073 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
= (0.886/1280) x 1000 x 0.106
= 0.073 mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
= 0.8 + [(0.2 x 0.1792/1000 x 2400]
= 0.886 m^3/m^3

Where:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
= 4.48 x 0.04
= 0.1792 L/kg

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for epichlorohydrin calculated from EPISUITE™ using the MCI is 4.48 L/kg.
F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are no toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 0.0063 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
= (0.0896/1500) x 1000 x 0.106
= 0.0063 mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
$Kp_{soil} = K_{oc} \times f_{oc}$
= 4.48 x 0.02
= 0.0896 m^3/m^3

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for epichlorodhydrin calculated from EPISUITE™ using the MCI is 4.48 L/kg.
F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Epichlorohydrin is readily biodegradable and thus does not meet the screening criteria for persistence.

No data are available on bioaccumulation. However, based on the log K_{ow} of 0.45 L/Kg, bioaccumulation is not expected. Thus, epichlorohydrin does not meet the criteria for bioaccumulation.

No chronic aquatic toxicity studies on epichlorohydrin were available. The acute E(L)C_{50} values from the acute aquatic toxicity studies on epichlorohydrin are > 1 mg/L in fish, invertebrates and algae. Thus, epichlorohydrin does not meet the criteria for toxicity.

The overall conclusion is that epichlorohydrin is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Flam. Liq. Category 3, H226

Carc. Category 1B, H350 (Oral)

Acute Tox. Category 3, H331 (Inhalation)

Acute Tox. Category 3, H311 (Dermal)

Acute Tox. Category 3, H301 (Oral)

Skin Corr. Category 1B, H314

Skin Sens. Category 1, H317

B. Labelling

Danger

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Skin Contact

Wear protective gloves when administering first aid. Wash thoroughly with soap and water for at least 15 minutes. Remove contaminated clothes and rinse affected area again.

Inhalation

If inhaled, remove from area to fresh air. Sit in half-upright position. Artificial respiration may be needed. Refer immediately for medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Vapor are heavier than air and may travel to a source of ignition and flash back.

If fire becomes uncontrollable or container is exposed to direct flame consider evacuation of one-third mile radius.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice. Use a chemical protection suit including self-contained breathing apparatus.

Do not touch or walk through spilled material.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed. For a small spill absorb with earth, sand, or other non-combustible material and transfer to containers for later disposal.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place. Make sure the container is fireproof. Keep separated from strong oxidants, acids, bases aluminium, sinc amines and food and feedstuffs.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

The workplace exposure standards for epichlorohydrin in Australia is as follows: time weighted average 7.6 mg/m^3.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Wear positive pressure self-contained breathing apparatus (SCBA).

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Epichlorohydrin is considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is required. Class 6.1 UN No 2023.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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ETHYLENE DIAMINETETRAACETIC ACID TETRASODIUM SALT [NA_4EDTA]

This dossier on ethylene diaminetetraacetic acid tetrasodium salt (Na_4EDTA) presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities It does not represent an exhaustive or critical review of all available data. The information presented in this dossier was obtained primarily from the EU Risk Assessment Report on Na_4EDTA, and the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Based on an assessment of environmental hazards, NICNAS identified Na_4EDTA as a chemical of low concern to the environment (DoEE, 2017a). Chemicals of low concern are unlikely to have adverse environmental effects if they are released to the environment from coal seam gas operations.

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): Tetrasodium{[2-bis-carboxymethyl-amino)-ethyl]-carboxymethyl-amino}-acetate

CAS RN: 64-02-8

Molecular formula: $C_{10}H_{12}N_2O_8Na_4$

Molecular weight: 380.2 g/mol

Synonyms: Tetrasodium ethylenediaminetetraacetate; ethylenediaminetetraacetic acid tetrasodium salt; ethylene dinitrilotetraacetic tetrasodium salt; Edetic acid tetrasodium salt; Na_4EDTA or Na_4EDTA tetrasodium; Edetate sodium or Sodium ededate; N,N'-1,2-Ethanediylbis[N-(carboxymethyl)glycine]tetrasodium salt; tetrasodium 2,2',2'',2'''-(ethane-1,2-diyldinitrilo)tetraacetate

SMILES: C(CN(CC(=O)[O-])CC(=O)[O-])N(CC(=O)[O-])CC(=O)[O-].[Na+].[Na+].[Na+].[Na+]

II. PHYSICO-CHEMICAL PROPERTIES

Table 1: Overview of the Physico-chemical Properties of Na_4EDTA

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	White powder	2	ECHA
Melting Point	>150°C; >300°C; decomposition may occur at >150°C (pressure not provided)	2	ECHA
Boiling Point	Not applicable, substance decomposes before boiling	-	ECHA
Density	1670 kg/m^3 @ 20°C	2	ECHA
Vapour Pressure	0 hPa @ @ 25°C	2	ECHA
Partition Coefficient (log K_{ow})	Not applicable, substance is a salt	-	ECHA

Property	Value	Klimisch score	Reference
Water Solubility	500 g/L @ 20°C	2	ECHA
Auto flammability	> 200 °C @ 101.3 kPa	2	ECHA
Viscosity	Not applicable, substance is a solid	-	ECHA
Henry's Law Constant	Not relevant	-	ECHA

The most important property of Na_4EDTA is that it forms complexes (usually 1:1-complexes) with multivalent metal ions (EU, 2004).

III. ENVIRONMENTAL FATE SUMMARY

A. Summary

Na_4EDTA is not readily biodegradable, but it can under certain conditions (i.e., alkaline pH), which is realistic under environmental surface water conditions, be degraded. Therefore, it can be concluded that EDTA is ultimately biodegradable under such environmental conditions (REACH). It is not expected to adsorb to soil or sediment. Na_4EDTA has a low potential for bioaccumulation.

B. Partitioning

Na_4EDTA is typically released to the environment in its complexed form (Nowack et al., 2001). The speciation of metal complexes is determined by the complex released, and metal exchange reactions mediated by its interactions with the chemistry of the receiving water compartment (Nowack, 2002; EU, 2004). However, complexes of Na_4EDTA with iron(III) are often detected in river water due to the ubiquity of iron(III) and the slow kinetics of relevant metal exchange reactions (half-life approximately 20 days) (Nowack, 2002).

Partitioning of complexed EDTA between water and sediment compartments is dependent on the metal ion complexed. For example, EDTA complexed with cobalt(III) and iron(III) partitions predominately to the water compartment, while lead(II) EDTA complexes adsorb strongly to sediment (Nowack, 2002).

Na_4EDTA is resistant to hydrolysis. However, EDTA is photolytically unstable when complexed with iron(III) ions. The complex is reported to have a half-life of 5 hours in central Europe in summer, with a worst-case half-life of 20 days (EU, 2004).

C. Biodegradation

There have been many degradation tests conducted on Na_4EDTA; in most cases, the acid or the sodium salt was tested, but not Na_4EDTA in its complexed form. Na_4EDTA is not readily biodegradable (EU, 2004). In a 28-day Sturm test, there was only 10% degradation (measured as CO_2) after 28 days (EU, 2004). In a Closed Bottle test, degradation was 3% and 0% of TOD after 28 days in two separate tests (EU, 2004). Inherent biodegradability tests have shown variable results, ranging from 0 to 37% biodegradation rates (EU, 2004). If a chemical is found to be not readily or inherently biodegradable, it is categorised as Persistent since its half-life is greater than 60 days (DoEE, 2017).

Na_4EDTA can be degraded under alkaline conditions. A Closed Bottle test was conducted to investigate the potential of samples from a river, a ditch and a lake to degrade $CaNa_2EDTA$ (8 mg/L) at pH values 6.5 – 8.0. There was little to no biodegradation (2-12%) at pH 6.5 within the first 28

days and 60-83% after 49 days. At pH 8, rates of 53, 62 and 72% were seen after 28 days and 75-89% after 35 days (van Ginkel et al., 1999). The pH values of lakes and river water range from 7.7 to 8.5; however, Na_4EDTA is preferably complexed with heavy metal ions (EU, 2004).

Na_4EDTA can be biodegraded in soil under aerobic conditions. After four weeks, biodegradation of Na_4EDTA between 4.8 and 7.9% at 30°C was determined in agriculture soil of mid-Michigan (EU, 2004). Another study showed primary degradation of 53 to 60% after 173 days at 22°C. An additional 39% of the substance was assumed to be eliminated by sorption and abiotic degradation (EU, 2004). No biodegradation has been observed under anaerobic conditions (AICIS, 2025).

D. Environmental Distribution

Environmental transport of Na_4EDTA will be determined by the metal ions it is complexed with. Most studies investigating the transport of Na_4EDTA complexes compare this to transport of the uncomplexed metal. Generally, Na_4EDTA is found to decrease adsorption of metals and therefore increase its potential for transport in the environment. For instance, the mobility of Na_4EDTA in soil was investigated by eluting solutions of H_4EDTA and ZnEDTA through cores of two various surface soils. H_4EDTA was slightly adsorbed and moved quite readily through both soils. The Na_4EDTA from ZnEDTA also moved readily through the soils (EU, 2004). Therefore, due to the ionic structure of Na_4EDTA, no adsorption to the organic fraction of soils is expected under environmental relevant pH conditions and the substance is expected to be mobile.

If released to water, Na_4EDTA will not evaporate from the water surface into the atmosphere and, based on its high water solubility value and ionic structure noted above, is likely to remain in water and not adsorb to sediment.

E. Bioaccumulation

Due to the ionic nature of EDTA and EDTA complexes in solution, EDTA species in the environment are expected to have low lipophilicity (AICIS, 2025). BCF values of 1.8 (0.08 mg/L Na_4EDTA) and 1.1 (0.76 mg/L Na_4EDTA) were determined in a 28-day bioaccumulation test on *Lepomis macrochirus* (EU, 2004). These measured values indicate a low potential for bioaccumulation.

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Na_4EDTA exhibits low acute toxicity by the oral route. It is irritating to the eyes. Data on other sodium salts of EDTA show that these substances are not skin sensitizers. Exposures of sodium EDTA salts to rats in their diet for up to two years showed no systemic effects. No systemic effects were seen in rats exposed by inhalation to a sodium EDTA salt for 13 weeks, although there were some localised (site-of-contact) effects seen in the respiratory tract. Sodium EDTA salts are not considered to be genotoxic or carcinogenic. It is not a reproductive or developmental toxicant.

B. Acute Toxicity

Oral

For Na_4EDTA, the oral LD_{50} values in rats from three different studies range from 1,700 to 1,913 mg/kg; two additional limit studies reported the oral LD_{50} values to be > 2,000 mg/kg (EU, 2004).

Inhalation

No acute inhalation studies have been conducted on Na_4EDTA. In a study on Na_2EDTA (CAS No. 139-33-3), male Wistar rats were exposed nose-only to an aerosol of 0, 30, 300 or 1,000 mg/m^3 for 6 hours on five consecutive days. Exposure to 1,000 mg/m^3 for one day (6 hours) resulted in deaths of 6 out of 20 animals (ECHA) [KI score = 1].

Dermal

No dermal toxicity studies on Na_4EDTA are available.

C. Irritation

Application of 0.5 g (in 80% water) of Na_2EDTA to the skin of rabbits for 4 hours under occlusive conditions was not irritating. The mean of the 24, 48, and 72-hour erythema scores was 0.4. The mean of the 24, 48, and 72-hour oedema scores was 0 (ECHA) [KI score = 1]. Application of a 40% solution of Na_4EDTA in water (CAS No. 67401-50-7) with a pH 11 to the skin of rabbits for up to 20 hours under occlusive conditions was not irritating (ECHA) [KI score = 2].

Instillation of 50 mg of Na_4EDTA into the eyes of rabbits was irritating. The mean 24 and 72-hour scores were: 1.25 for corneal lesions; 1.75 for conjunctival redness; 1.25 for chemosis; and 0 for iridial lesions (ECHA) [KI score = 2].

D. Sensitisation

No sensitization studies have been conducted on Na_4EDTA. Na_3EDTA was not a dermal sensitizer in a guinea pig sensitization study (ECHA) [KI score = 2].

Na_2EDTA was not a dermal sensitizer in a guinea pig maximisation test. The intradermal injection was 0.5% in corn oil; the topical applications were 30% in corn oil, and the challenge dose was 30% in corn oil (ECHA) [KI score = 1].

E. Repeated Dose Toxicity

Oral

Male Holtzman rats were fed in their diet 0, 1, 5, or 10% (0, 500, 2,500 or 5,000 mg/kg/day) Na_2EDTA for 90 days. There was mortality in the mid- and high-dose groups: 20% and 60%, respectively. Body weights and food consumption were significantly lower in the mid- and high-dose groups compared to controls. The animals in these two groups also had diarrhea and were emaciated, and water consumption was increased. The 10% group showed intermittent decreases in hematocrit and haemoglobin levels, and the livers appeared pale when examined at necropsy. Histopathologic evaluation showed no treatment-related effects. The NOAEL is 500 mg/kg/day (Wynn et al., 1970; ECHA) [KI score = 2].

Male and female F344 rats were fed in their diet 0, 3,750 or 7,500 ppm (0, 248 or 495 mg/kg/day) Na_3EDTA. There were no clinical signs; survival and body weights were similar between treated and control groups throughout the study. There was no evidence of adverse effects in the gross necropsy and histopathologic examinations. The NOAEL is 495 mg/kg/day (EU, 2004) [KI score = 2].

Male and female B6C3F1 mice were fed in their diet 0, 3,750 or 7,500 ppm (0, 469 or 938 mg/kg/day) Na_3EDTA. There was no clinical signs and survival was similar across all groups. Body

weights in the high-dose males showed a significant decrease in body weights throughout the study. There was no evidence of adverse effects in the gross necropsy and histopathologic examinations. The NOAEL is 938 mg/kg/day (NCI, 1977) [KI score = 2].

Inhalation

Male and female Wistar rats were exposed nose-only to 0, 0.5, 3 or 15 mg/m^3 Na_2EDTA (as an aerosol dust) 6 hours/day, 5 days/week for 13 weeks. The MMAD of the particles for the respective groups were: 2.3 - 2.8 µm, 2.0 – 2.4 µm and 2.3 – 2.5 µm, respectively. There were no clinical signs of toxicity or any effects on the haematology and clinical chemistry parameters. Histopathological examination showed some effects on the larynx in the 15 mg/m^3 females, but no evidence of systemic toxicity. The NOAEC for systemic toxicity in this study is 15 mg/m^3. The NOAEC for localized (site-of-contact) effects is 3 mg/m^3 (ECHA) [KI score = 1].

Dermal

No dermal studies are available.

F. Genotoxicity

In Vitro Studies

There are no *in vitro* genotoxicity studies on Na_4EDTA; however, studies have been conducted on Na_2EDTA and Na_3EDTA (Table 2).

Table 2: In Vitro Genotoxicity Studies on Na_2EDTA and Na_3EDTA

Test System	Test Substance	Results*		Klimisch Score	Reference
		-S9	+S9		
Bacterial reverse mutation (*S. typhimurium* and *E. coli* strains)	Na_3EDTA	-	-	2	ECHA
Mammalian cell gene mutation (mouse lymphoma L5178Y cells)	Na_2EDTA	-	-	2	ECHA
Mammalian cell gene mutation (mouse lymphoma L5178Y cells)	Na_3EDTA	-	-	2	ECHA
Chromosomal aberration (CHO cells)	Na_3EDTA	-	-	2	ECHA
Cell transformation assay (Syrian hamster embryos)	Na_2EDTA	N/A	-	1	ECHA
Cell transformation assay (Syrian hamster embryos)	Na_3EDTA	N/A	-	2	ECHA

*+, positive; -, negative; N/A, not applicable.

In Vivo Studies

There are no *in vivo* genotoxicity studies on Na_4EDTA. Studies conducted on other sodium salts of EDTA are summarised below.

Male NMRI mice were dosed by oral gavage with 0, 500, 1,000 or 2,000 mg/kg Na_2EDTA once daily for two consecutive days. There were no increased frequencies of micronuclei in the

normochromatic erythrocytes of the bone marrow in the treated animals compared to controls (ECHA) [KI score = 1].

Male Balb/c mice were given a single intraperitoneal injection of 0, 93 or 186 mg/kg Na_2EDTA and the spermatocytes were examined 6 hours and 5 days later for aneuploidy. There were no significant increases in aneuploidy in the primary and secondary spermatocytes at both time points (Zordan et al., 1990; ECHA) [KI score = 2].

Male Balb/c mice were given a single intraperitoneal injection of 0 or 186 mg/kg Na_2EDTA, and the frequency of micronuclei was analysed in the Golgi and Cap phase, which represents the two earliest phases of spermatid development. The sampling time points were 24 and 48 hours post-dosing. Micronuclei were induced in the Golgi phase spermatids at both time points; there was no increase in micronuclei in the Cap phase (Russo and Lewis, 1992; ECHA) [KI score = 2].

No chromosomal aberrations were noted in male Balb/c mouse spermatogonia following a single intraperitoneal dose of 186 mg/kg Na_2EDTA (Russo and Lewis, 1992; ECHA) [KI score = 2].

In summary, Na_2EDTA did not induce genotoxicity in bone marrow cells in mice. In germ cells of mice, Na_2EDTA did not induce chromosomal aberrations in spermatogonia, aneuploidy in primary and secondary spermatocytes, but micronuclei were induced at a specific phase of spermatogenesis. The dose of Na_2EDTA used to induce micronuclei in these spermatids is an extremely high dose; given that the induction of aneuploidy is based on a threshold mode-of-action, it is unlikely that this effect will occur in humans exposed to sodium salts of EDTA. Overall, the sodium salts of EDTA are not genotoxic (EU, 2004).

G. Carcinogenicity

Oral

No studies are available on Na_4EDTA.

Male and female F344 rats were fed in their diet 0, 3,750 or 7,500 ppm (0, 248 or 495 mg/kg/day) Na_3EDTA. There were no clinical signs; survival and body weights were similar between treated and control groups throughout the study. Tumour incidences were similar across all groups, indicating no evidence of carcinogenicity from chronic exposure to Na_3EDTA (NCI, 1977) [KI score = 2].

Male and female B6C3F1 mice were fed in their diet 0, 3,750 or 7,500 ppm (0, 469 or 938 mg/kg/day) Na_3EDTA. There were no clinical signs and survival was similar across all groups. Body weights in the high-dose males showed a significant decrease in body weights throughout the study. Tumour incidences were similar across all groups, indicating no evidence of carcinogenicity from chronic exposure to Na3EDTA (NCI, 1977) [KI score = 2].

No inhalation or dermal carcinogenicity studies were located.

H. Reproductive Toxicity

No studies are available on Na_4EDTA.

Male and female Wistar rats were given in their feed 0, 50, 125 or 250 mg/kg/day CaNa2EDTA (CAS No. 62-33-9) for two years. The study included reproductive and lactation components in four successive generations. There were no significant differences between treated and controls groups

in behaviour, clinical signs, survival, body weight gain in any generation. The high-dose group showed no treatment-related organ weight changes or histopathologic effects in any of the organs examined, including the testes. There were no consistent treatment-related effects on reproductive performance or developmental effects in any of the four generations examined. The NOAEL for reproductive toxicity is 250 mg/kg/day, the highest dose tested (Oser et al., 1963; ECHA) [KI score = 2].

I. Developmental Toxicity

Pregnant female rats were dosed by oral gavage with 0 or 1,000 mg EDTA/kg during GD 7-14. The salts of EDTA (Na_2EDTA, Na_3EDTA, $CaNa_2EDTA$ and Na_4EDTA were also included in this study and were tested on an equimolar basis. For Na_4EDTA, the dose is 1,374 mg/kg/day which was given as equally divided doses twice daily. There was diarrhea in 90% of the dams after each daily dosing and which disappeared after the last day of dosing. There was also reduced feed intake and reduced weight gain during the treatment period; both recovered during the post-treatment period. There was no developmental toxicity in any of the treatment groups compared to controls. The NOAEL for maternal and developmental toxicity for Na_4EDTA is 1,374 mg/kg/day (Schardein et al. 1981; ECHA).

The toxicity and teratogenicity of Na_2EDTA were studied in pregnant female CD rats following different routes of administration during GD 7-14. When Na_2EDTA was administered in the diet at 3% (average dose of 954 EDTA/kg/day), the dams had reduced feed intake, severe diarrhea and severe weight loss. There was a significant proportion of foetal deaths (~33% resorptions/litter), significantly lower average foetal weight and gross external, internal and skeletal malformations in about 71% of the surviving foetuses. When Na_2EDTA was administered by oral gavage at doses of 1,250 or 1,500 mg EDTA/kg/day, there was severe toxicity to the dams: 3/8 and 7/8 deaths in the 1,250 and 1,500 mg/kg/day groups, respectively; significantly reduced weight gain and diarrhea in the 1,250 mg/kg/day group. There was a significantly higher proportion of malformed surviving foetuses. When administered subcutaneously with 375 mg EDTA, the dams showed signs of severe pain (vocalisations and shock) and 24% of them died; there was also a significant reduction in body weight and feed intake. Foetal toxicity included about 32% resorptions/litter and significant reduction of foetal body weight, and about a 4% malformed survivors/litter (Kimmel, 1977; ECHA).

Pregnant female CD rats were given in their diet 0, 2, or 3% Na_2EDTA; in addition, a group was fed 3% Na_2EDTA supplemented with 1,000 ppm zinc (Zn). Exposures were as follows: 2% (GD 0-21), 3% (GD 0-21, GD 6-14, or GD 6 to 21); 3% + Zn (GD 6-21). The dietary doses of 2% and 3% Na_2EDTA correspond to approximately 1,000 and 1,500 mg/kg/day, respectively. All of the dams had moderate to severe diarrhea. In the 2% Na_2EDTA group, all rats had living young at term; the litter size was normal; the young were slightly small than controls, and 7% of the foetuses were malformed. In the 3% Na_2EDTA (GD 0-21), reproduction was severely disturbed, and none of the females had grossly visible implantation sites. In the 3% Na_2EDTA (GD 6-14 and 6-21), almost all females had implantation sites; half of the sites had dead or resorbed foetuses; 100% of the foetuses were malformed in the GD 6-21 group. In the 3% Na_2EDTA + Zn group, there was a normal reproduction, and none of the young was malformed. It was suggested by the study authors that the congenital abnormalities caused by EDTA were due specifically to zinc deficiency (Swenerton et al., 1977).

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

Toxicological reference values were not derived for Na_4EDTA.

The Australian drinking water guidance value for EDTA is 0.25 mg/L (ADWG, 2021).

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Na_4EDTA does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Details on the aquatic toxicity studies on Na_4EDTA and its sodium salts can be found in the EU Risk Assessment Report (RAR) on Na_4EDTA (EU, 2004) and the AICIS EDTA and its Salts and Complexes report (AICIS, 2025). The mode-of-action of Na_4EDTA in aquatic systems involves disturbances of metal metabolism; hence the complex formation properties of Na_4EDTA need to be taken into account. Limited relevant studies on terrestrial toxicity are available.

B. Aquatic Toxicity

Uncomplexed Na_4EDTA will only be present in the test media of aquatic toxicity studies when present in an excess amount relative to the calcium and magnesium ions, as well as some level of heavy metal ions, which are present mainly as trace nutrients. Complexes with the heavy metals predominant because the formation constants are several orders of magnitude higher than those of the calcium and magnesium ions. After addition of Na_4EDTA (as an acid or sodium salt), the concentration of uncomplexed trace metals will decrease considerably, and if there is a surplus of Na_4EDTA, there will also be complexing with the calcium and magnesium ions.

Na_4EDTA toxicity to aquatic organisms is influenced by several factors, such as which metals it forms complexes with, water hardness, and pH. For example, complexes with calcium and magnesium typically are less toxic than those with copper and zinc. In addition, the protonated form of Na_4EDTA may decrease pH to detrimental levels and free Na_4EDTA is more toxic in soft water than hard water (AICIS, 2025).

Na_4EDTA and its sodium salts appear to be more toxic in an uncomplexed form in the acute toxicity studies. Most of the acute fish studies have LC_{50} values that are much greater than 100 mg/L (e.g., 96-hour LC_{50} value of 157 mg/L), with the exception of two studies tested with H_4EDTA in soft and very soft water: the LC_{50} values were 41 and 59.8 mg/L, respectively. It is thought that there was an excess of uncomplexed Na_4EDTA in the test media of these two studies due to the low levels of magnesium and calcium ions in soft water; this, however, is an unlikely scenario in the environment.

The EU RAR (EU, 2004) considered the most relevant chronic fish toxicity study to be an early-life stage test on zebrafish; the NOEC was >26.8 mg/L H_4EDTA ($CaNa_2EDTA$ was the test substance) (EU, 2004). The AICIS report (AICIS, 2025) also identified a zebrafish study, but with a NOEC of >36.9 mg/L.

The acute toxicity tests on *Daphna magna* reported 24-hour EC_{50} values of 480 to 790 mg/L (EU, 2004) and a 48-hour EC_{50} value of 101 mg/L (AICIS, 2025). The 21-day NOEC from a *Daphnia* reproduction test was 25 mg/L (EU, 2004; AICIS, 2025).

Essential trace metal bioavailability seems to be the critical factor in algal toxicity from Na_4EDTA exposure. The ratio of the Na_4EDTA concentration to the metal cations is a critical element to algal

growth and not the absolute Na_4EDTA concentration. Concentrations of H_4EDTA up to 310 mg/L will not cause any effect on algal growth if there is sufficient trace metals present. Since there is a considerable amount of metal ions present in the environment, Na_4EDTA is not expected to have an intrinsic toxic effect on plants. In a study with *Scenedesmus subspicatus*, an EC_{10} value of 0.37 mg/L was obtained (EU, 2004). The EU RAR considered that the effect was probably due to nutrient deficiency because essential metals (Cu, Zn, Co) are largely complexed to the Na_4EDTA, resulting in considerably reduced concentrations. In another study with *Pseudokirchnerella subcapitata* conducted according to OECD TG 201, the ECb_{50} and ECr_{50} of Fe(III)EDTA were >100 mg/L; the NOEC values were 79.4 and 48.4 mg/L, respectively, when based on mean measured concentrations. A study with *Raphidocelis subcapitata* identified a 72-hour EC_{50} value of >71 mg/L and NOEC of 57 mg/L based on growth rate (AICIS, 2025).

C. Terrestrial Toxicity

Na_4EDTA in interaction with sodium iron (3+) can have acute toxicity on earthworms and plants in the soil based on limited information. In a study with *Eisenia fetida* (earthworm), a 14-day LC_{50} value of 156.5 mg/kg was obtained for Na_4EDTA. In another study with *Glycine max* (soybean), 21-day EC_{50} values of 111 and 714 mg/kg were obtained for Na_4EDTA together with sodium iron (3+).

A study identified no toxicity to birds with a 14-day LC_{50} value of >5,000 mg/kg for Na_4EDTA together with sodium iron (3+) using *Colinus virginianus* (bobwhite quail) (AICIS, 2025).

D. Calculation of PNEC

The PNEC calculations for Na_4EDTA follow the methodology discussed in DEWHA (2009).

PNEC water

Experimental results are available for three trophic levels. Results from chronic studies are also available for all three trophic levels, with the lowest NOEC being 22 mg/L for algae (EU, 2004). On the basis that the data consists of short-term and long-term results from three trophic levels, an assessment factor of 10 has been applied to the lowest reported long-term NOEC of 22 mg/L for invertebrates. The $PNEC_{water}$ is 2.2 mg/L.

PNEC sediment

No experimental toxicity data on sediment organisms are available. The equilibrium partitioning method cannot be used to calculate the $PNEC_{sed}$ because Na_4EDTA is not expected to adsorb to sediment. The assessment of this compartment will be covered by the aquatic assessment.

PNEC soil

No experimental toxicity data on soil organisms are available. The equilibrium partitioning method cannot be used to calculate the $PNEC_{soil}$ because Na_4EDTA is not expected to adsorb to soil. The assessment of this compartment will be covered by the aquatic assessment.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Na_4EDTA is not readily biodegradable; thus, it meets the screening criteria for persistence.

The experimental BCF of Na_4EDTA in fish is 1.1 – 1.8. Thus, Na_4EDTA does not meet the criteria for bioaccumulation.

The lowest NOEC from chronic aquatic toxicity studies is > 0.1 mg/L. Na_4EDTA and its sodium salts appear to be more toxic in an uncomplexed form in the acute toxicity studies. Acute EC_{50} values in fish, invertebrates and algae are > 1 mg/L. Thus, Na_4EDTA does not meet the screening criteria for toxicity.

The overall conclusion is that Na_4EDTA is not a PBT substance.

IX. CLASSIFICATION AND LABELING

A. Classification

Acute Toxicity Category 4 [oral]

Acute Toxicity Category 4 [inhalation]

Eye Damage Category 1

B. Signal Word

Danger

C. Pictogram



X. SAFETY AND HANDLING

A. First Aid

Eye Contact

Immediately flush open eyes with plenty of water for at least 15 minutes. Remove contacts, if present and easy to do. Get medical attention immediately.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion

Rinse mouth with water and then drink plenty of water. Never give anything by mouth to an unconscious person. If symptoms develop, seek medical advice.

Notes to Physician

All treatments should be based on observed signs and symptoms of distress in the patient.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide, nitrogen oxides.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus and chemical protective clothing.

C. Accidental Release Measures

Personal Precautions

Use personal protective clothing. Avoid dust formation. Ensure adequate ventilation. Do not breathe dust. Wear respiratory protection if ventilation is inadequate. Avoid contact with skin, eye, and clothing. Eliminate all sources of ignition.

Environmental Precautions

Prevent from entering sewers, waterways, or low areas.

Steps to be Taken if Material is Released or Spilt

Scoop up and remove.

D. Storage And Handling

General Handling

No special measures necessarily provided product is used correctly.

Other Handling Precautions

Avoid eye and skin contact. Avoid creating or inhaling dust. Take precautionary measures against static discharges by bonding and grounding equipment.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard for Na_4EDTA has not been established in Australia.

Engineering Controls

None

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye Protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Eyewash fountains and safety showers must be easily accessible.

F. Transport Information

Na_4EDTA is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods Code is not required.

XI. DISPOSAL MANAGEMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY INFORMATION

Australian AICS Inventory: Listed.

XIII. REFERENCES

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FATTY ACIDS, C14-18 AND C16-18-UNSATURATED

This dossier on fatty acids, C14-18 and C16-18-unsaturated presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed fatty acids, C14-18 and C16-18-unsaturated in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to human health.[1]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): Fatty acids, C14-18 (even numbered) and C16-18-unsatd.(even numbered)

CAS RN: 67701-06-8

Molecular formula: Not applicable - UVCB substance

Molecular weight: 228.4-284.5 g/mol

Synonyms: None

SMILES: Not applicable - UVCB substance

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of fatty acids, C14-18 and C16-18-unsaturated

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	White waxy solid	2	ECHA
Melting Point	-42°C @ 101.3 kPa	1	ECHA
Boiling Point	342°C @ 101.3 kPa	1	ECHA
Density	951 kg/m^3@ 20°C	1	ECHA
Vapour Pressure	≤ 0.027 Pa @ 20°C	2	ECHA
Partition Coefficient (log K_{ow})	7.319 @ 20°C	2	ECHA
Water Solubility	0.000135 – 0.000380 g/L @ 20°C	1	ECHA
Flash Point	> 180°C	2	ECHA
Auto flammability	> 250°C	2	ECHA

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=c97e433e-f36b-1410-8c14-0026b2c59b62

Property	Value	Klimisch Score	Reference
Viscosity	Study not technically feasible.	-	ECHA
Henry's Law Constant	Not relevant	-	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Fatty acids, C14-18 and C16-18-unsaturated is readily biodegradable with potential to adsorb to soil, suspended solids and sediments. Fatty acids are considered to pose no risk to aquatic organisms from their bioconcentration and biomagnification properties.

B. Biodegradation

The ready biodegradability of the target substance was assessed using a category approach based on the grouping of substances. The substances in the Fatty Acid (FA) category are readily biodegradable (> 60% in 28 d) according to OECD criteria (ECHA). [Kl. Score = 2].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

Information on the adsorption potential of fatty acids, C14-18 and C16-18-unsaturated was generated using a quantitative structure activity relationship (QSAR) model for ionisable substances. Since the substance is of UVCB nature, representative constituents were selected for QSAR estimations in ECHA. Based on the representative constituents that are present in the target substance, log soil organic carbon partition coefficient (K_{oc}) values were predicted to be 3.82-5.91 L/Kg at pH 4, 2.45-4.3 L/Kg at pH 7 and 2.1-2.73 L/Kg at pH 9. In addition, a molar fraction weighted average log K_{oc} of 3.52 L/Kg has been calculated for the target substance at pH 7, which is relevant for risk assessment. The lowest log K_{oc} of the target substance (considering constituents above 0.1%) is between 2 and 3 L/Kg at pH 7 and 9 (ECHA). [Kl. Score = 2].

Based on these K_{oc} values, if released to soil, the substance is expected to moderately to strongly sorb to soil and have moderate to slight mobility. If released to water, based on these K_{oc} values and limited water solubility, the substance is expected to strongly sorb to suspended solids and sediments.

D. Bioaccumulation

Bioaccumulation studies were waived based on the conclusion that fatty acids occur naturally in all aquatic organisms, are ubiquitous in the aquatic environment and are predominantly readily biodegraded in an aerobic environment by microorganisms. Although the range of log K_{ow} values given suggests that fatty acids with chain length greater than C12 may be expected to have tendency of a higher bioaccumulation. However, this takes into account of the physicochemical properties of chemicals and only indicates intrinsic potential of the substance, but not of its behaviour in the environment, for instance, biodegradation, and in living organism, for example, metabolism. Whereas, a bioconcentration derived from experiments using radiolabelled compounds, in which differentiation between parent compounds and metabolites or other breakdown products is not

possible. Furthermore, as fatty acids are the end products of carbohydrate metabolism in living organisms muscle tissues, an evaluation of anthropogenic distribution of fatty acids based on the concentrations determined in the organs and tissues of aquatic organisms may overestimated. Fatty acids are considered to pose no risk to aquatic organisms from their bioconcentration and biomagnification properties (ECHA).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Based on the available data, almost complete absorption of the substances of the FA category after oral exposure is expected. Dermal uptake of fatty acids in humans needs to be considered, albeit to a much lower degree than oral absorption. Fatty acids, C14-18 and C16-18-unsatd has low or no potential for acute oral or dermal toxicity. This material is not a skin irritant or sensitiser; however, it is potentially irritating / corrosive to the eyes. This material has a low potential to cause systemic, reproductive or developmental toxicity following oral exposure. It is not genotoxic.

B. Metabolism

Based on the available data, almost complete absorption of the substances of the FA category after oral exposure is expected. Dermal uptake of fatty acids in humans needs also be considered, albeit to a much lower degree than oral absorption. Under normal physiological conditions, fatty acids are rapidly β-oxidised in mitochondria and peroxisomes. The resulting main metabolites of β-oxidation are acyl-carnitines, acetyl-CoA and fatty acyl-CoA for even- and odd-numbered fatty acids. After metabolism, the primary route of excretion will be via exhaled air.

C. Acute Toxicity

Oral

An acute oral toxicity study was conducted in accordance with OECD 401. Male and female Wistar rats (5 animals per sex per dose) were exposed to 2000 mg/kg bw/day by oral gavage. The animals were observed for 14 days for signs of toxicity. There were no mortalities in this study. The LD50 for acute oral toxicity was >2000 mg/kg bw/day (ECHA). [Kl. Score=2]

Inhalation

ECHA determined that an acute inhalation toxicity study is not needed.

Dermal

The available data on acute dermal toxicity in the Fatty Acid (FA) category reveals a dermal LD50 value > 2000 mg/kg bw indicating no/low hazardous properties of the fatty acids after acute dermal exposure. (ECHA). [Kl. Score=2]

D. Irritation

Skin

In an in vitro skin irritation study (OECD 439), the human three-dimensional epidermal model (EPISKIN-SM™), was used. The relative mean tissue viability after 15 minutes of exposure to fatty acids, C14-18 and C16-18-unsatd was 106% compared to control. Also, at 42 hrs post-exposure, the

mean viability was >50%. test material Since the mean relative tissue viability was above 50%. Fatty acids, C14-18 and C16-18-unsatd is concluded to be non-irritant (ECHA). [Kl. Score=1]

Eye

In this in vitro eye irritation study using the reconstructed human EpiOcular™ model (OECD 492), the relative mean tissue viability obtained after 6 hours ± 15 min treatment with fatty acids, C14-18 and C16-18- unsaturated compared to the negative control tissues was 37%. Since the mean relative tissue viability for the test item was below 60%, the test item is considered to be potentially irritant or corrosive to the eye (ECHA). [Kl. Score=2]

E. Sensitisation

In this in vitro skin sensitisation study using the GARDskin™ assay (OECD 442E), the mean Decision Value (DV) obtained after 24 ± 0.5 hours treatment with fatty acids, C14-18 (even numbered) and C16-18-unsatd. (even numbered) was positive. Since the calculated mean DV was above 0, the test item is classified as sensitiser. However, as the activation of dendritic cells as measured in the GARDskin™ assay represents only one key event of the skin sensitisation Adverse Outcome Pathway (AOP), this in vitro assay is not considered sufficient as a stand-alone method to conclude on the presence or absence of skin sensitisation potential of the substance. Therefore, a "weight-of-evidence" approach as stated in OECD 497 with at least two conclusive results and/or within the context of an integrated approach to testing and assessment (IATA) together with other information may still be considered sufficient to cover the hazard endpoint of skin sensitisation (ECHA). [Kl. Score=1] .

In this *in vitro* skin sensitisation study using the KeratinoSens™ assay (OECD 442D), the test material showed toxicity and a biologically and statistically relevant dose-related induction of the luciferase activity was measured in the fifth experiment. Appropriate negative and positive controls were used and gave expected results. Based on this assay, fatty acids, C14-18 (even numbered) and C16-18-unsatd. (even numbered) is considered to be positive in the ARE-Nrf2 Luciferase Test , since in 2 out of the 3 concluding experiments (experiment 2 and 5) positive results (>1.5-fold luciferase induction) were observed at test concentrations up to 200 µg/mL. However, as the keratinocyte activation represents only one key event of the skin sensitisation Adverse Outcome Pathway (AOP), this *in vitro* assay is not considered sufficient as a stand-alone method to conclude on the presence or absence of skin sensitisation potential of the substance(ECHA). [Kl. Score=1] .

F. Repeated Dose Toxicity

Oral

In a combined repeated dose toxicity study with the reproduction/developmental toxicity screening test (OECD 422), male and female Wister rats were exposed daily to 100, 300, or 1000 mg/kg bw/day fatty acids, C14-18 (even numbered) and C16-18-unsatd by oral gavage. Males were exposed for a minimum of 28 days, including at least 2 weeks of treatment prior to mating and during the mating period up to and including the day before scheduled necropsy. Females were exposed for at least 14 days prior to mating, the variable time to conception, the duration of pregnancy and at least 13 days after delivery, up to and including the day before scheduled necropsy. No dosing during littering. No test material-related clinical signs were noted during the study period. No mortality observed and no effects on body weights or food consumption. There were no treatment related effects on haematology, clinical biochemical, endocrine, behavioural, organ weights, gross pathology or histopathology. The no observed adverse effect level (NOAEL) for systemic toxicity was concluded to be ≥ 1000 mg/kg bw/day for male and female rats (ECHA). [Kl. Score=1]

Inhalation

No data available

Dermal

No data available

G. Genotoxicity

Fatty acids, C14-18 and C16-18-unsaturated are not genotoxic based on *in vitro* testing.

In Vitro Studies

The *in vitro* genotoxicity studies on fatty acids, C14-18 (even numbered) and C16-18-unsatd are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on **fatty acids, C14-18 (even numbered) and C16-18-unsatd**

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial Reverse Mutation Assay (OECD 471)	-	-	1	ECHA
Mammalian Cell Micronucleus Test (OECD 487)	-	-	1	ECHA
Mammalian Cell Gene Mutation Test (OECD 490)	-	-	1	ECHA

*+, positive; -, negative

In Vivo Studies

No data available

H. Carcinogenicity

Oral

For the members of the Fatty Acid category no data are available for carcinogenicity. There is no evidence that fatty acids cause carcinogenicity by a direct genotoxic mechanism, as the results of all available genetic toxicity studies were negative. Furthermore, in repeated dose toxicity studies and developmental toxicity studies, no evidence for hyperplasia or pre-neoplastic lesions was seen. No such lesions were found in any study, except hyperplasia of the squamous epithelium with non-adverse hyperkeratosis of the forestomach observed in studies with fatty acids of short chain length ≤ C9 indicative of the highly irritating properties of the substances (ECHA).

Inhalation

No data available

Dermal

No data available

I. Reproductive and Developmental Toxicity

In a combined repeated dose toxicity study with the reproduction/developmental toxicity screening test (OECD 422), male and female Wister rats were exposed daily to 100, 300, or 1000 mg/kg bw/day fatty acids, C14-18 (even numbered) and C16-18-unsatd by oral gavage. Males were exposed for a minimum of 28 days, including at least 2 weeks of treatment prior to mating and during the mating period up to and including the day before scheduled necropsy. Females were exposed for at least 14 days prior to mating, the variable time to conception, the duration of pregnancy and at least 13 days after delivery, up to and including the day before scheduled necropsy. No dosing during littering. No test material-related clinical signs were noted during the study period. No mortality observed and no effects on body weights or food consumption. There were no treatment related effects on haematology, clinical biochemical, endocrine, behavioural, organ weights, gross pathology or histopathology. The NOAEL for systemic toxicity was concluded to be ≥ 1000 mg/kg bw/day for male and female rats (ECHA). [Kl. Score=1]

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for fatty acids, C14-18 (even numbered) and C16-18-unsatd follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

The lowest NOAEL from these studies is >1000 mg/kg bw/day based on overall toxicity in a Combined Repeated Dose Toxicity Study with the Reproduction / Developmental Toxicity Screening Test conducted on rats. The NOAEL of >1000 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = >1000/(10 x 10 x 1 x 10 x 1) = 1000/1000 = 1.0 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (1.0 x 70 x 0.1)/2 = 3.5 mg/L

B. Cancer

There is no evidence that fatty acids cause carcinogenicity. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Fatty acids, C14-18 (even numbered) and C16-18-unsatd. does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Fatty acids, C14-18 and C16-18-unsaturated is expected to have low toxicity to aquatic and terrestrial organisms. In the aquatic environment, no effects up to the limit of water solubility are expected.

B. Aquatic Toxicity

Acute Studies

Experimental data on the short-term toxicity of fatty acids, C14 - C18 (even numbered) and C16- 18 unsaturated to aquatic invertebrates is available from one guideline study. Fatty acids, C14 - C18 (even numbered) and C16 - C18 unsaturated was tested on the marine copepod *Acartia tonsa* using saltwater. The semi-static test was conducted according to ISO 14699 in accordance with GLP-requirements. A series of test concentrations of nominal 100, 320, 560, 1000 and 3200 mg/L were used. No analytics were performed to monitor the actual test item concentrations throughout the exposure period. The 48-hr LC_{50} after 48 h was reported as 357.5 mg/L (nominal). Concluding from the results, no toxic effects on invertebrates within the range of water solubility are expected for fatty acids, C14 - C18 (even numbered) and C16- 18 unsaturated (ECHA). [Kl. Score = 2]

Table 3 lists the results of acute aquatic toxicity studies conducted on read-across fatty acids with saturated and unsaturated carbon chains with lengths between C14 and C18.

Table 3: Acute Aquatic Toxicity Studies on Read-Across Fatty Acids

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Oryzias latipes (Japanese rice fish)	96-hr LC_{50}	>1.9 (myristic acid [CAS 544-63-8]) * >6.9 (palmitic acid [CAS 57-10-3]) * >2.5 (oleic acid [CAS 112-80-1]) *	-	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	>1.7 (myristic acid) * >0.25 (palmitic acid) * >2.8 (oleic acid) *	-	ECHA
Raphidocelis subcapitata (Green alga)	72-hr EC_{50}	>2.1 (myristic acid) + >0.85 (palmitic acid) + >2.6 (oleic acid) +	-	ECHA

Note: * indicates studies showed no effect up to the limit of water solubility and the value is based on the geometric mean.
+ indicates studies showed no effect up to the limit of water solubility and the value is based on the arithmetic mean.

Chronic Studies

Based on the currently available data and the overall conclusions derived from category read-across approach, data suggested that algae are less sensitive than daphnia and fish, while effective concentrations observed for daphnia indicated slightly higher sensitivity compared fish. Therefore, current assessment of the chronic aquatic toxicity focuses on long term toxicity to invertebrates (ECHA).

No chronic studies are available for fatty acids, C14-18 and C16-18-unsaturated. Two robust studies are available for group member myristic acid (C14, CAS No 544-63-8) to read-across fatty acids with saturated and unsaturated carbon chains with lengths between C14 and C18. In the first study, an exceed of acetone was used as solvent (final concentration 32 mg/L). Therefore, the study was conducted at concentration above the water solubility, ranging from 1.0 to 3.2 mg/L nominal, (corresponding to 0.23 – 0.80 mg/L, meas. TWA). A NOEC of 0.31 mg/L (meas. TWA) was reported. To verify the toxicity level and the potential artifacts due to exceed solvent concentration (according to OECD guideline: maximum of 0.1 mg/L is allowed), a supplementary limit test was conducted using the improved solvent application, at the nominal concentration of 10 mg/L. No effects were observed at the tested concentration, a NOEC ≥ 0.151 mg/L (meas. TWA), corresponding to 10 mg/L (nominal) was determined based on reproduction and used as key study for further hazard assessment. Additionally, a reliable long-term daphnia toxicity studies is available for palmitic acid (C16, CAS 57-10-3) with application of solvent (DMF, 0.1 mg/L) or dispersant (DMF and HCO-40, 40 mg/L). Since no effects up the highest tested concentrations were observed, no supplementary tests were carried out for this fatty acid. An additional study is available to assess unsaturated fatty acids. In the study, unsaturated C18:1 (oleic acid; CAS 112-80-1) caused significant reproductive inhibition without the use of a solvent, with a NOEC of 0.08 mg/L (meas. TWA). The relevance and impact of unsaturated fatty acids for the hazard assessment of UVCB substances within the category are currently under evaluation (ECHA).

C. Terrestrial Toxicity

No studies are available as testing was not required. Fatty acids are expected to undergo rapid mineralization in both aquatic and terrestrial environments, making environmental persistence unlikely. Fatty acids, C14-18 (even numbered) and C16-18-unsatd. (even numbered) is not volatile (vapor pressure: ≤ 0.027 Pa), thus air emissions are not a relevant exposure route. Additionally, the substances in Fatty Acid category show low potential for bioaccumulation and exhibited no toxic inhibition of aquatic microorganisms in ready biodegradability tests. Therefore, further testing on soil organisms is not considered scientifically necessary (ECHA).

D. Calculation of PNEC

The PNEC calculations for fatty acids, C14-18 and C16-18-unsaturated follow the methodology discussed in DEWHA (2009).

PNECs were not calculated for fatty acids, C14-18 and C16-18-unsaturated. Fatty acids dissociate into their anionic form under environmentally relevant pH conditions (pH 4–9). They are readily biodegradable and available aquatic toxicity data indicate that substances with chain lengths > C14 exhibit no adverse effects up to their water solubility limits. Further, they pose a low risk to the sediment and soil compartment.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Fatty acids, C14-18 and C16-18-unsaturated is readily biodegradable and thus does not meet the screening criteria for persistence.

Fatty acids are considered to pose no risk to aquatic organisms from their bioconcentration and biomagnification properties. Thus, fatty acids, C14-18 and C16-18-unsaturated does not meet the criteria for bioaccumulation.

Aquatic toxicity data indicate that substances with chain lengths > C14 exhibit no adverse effects up to their water solubility limits. Thus, fatty acids, C14-18 and C16-18-unsaturated does not meet the criteria for toxicity.

The overall conclusion is that fatty acids, C14-18 and C16-18-unsaturated is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Eye Irritation Category 2

B. Labelling

Warning

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

Immediately flush with luke-warm water 15 - 20 minutes with wide-open eyes; Transport the victim to hospital. Remove all solids.

Skin Contact

Wash with a great amount of water and contact physician.

Inhalation

Contact a physician (Poisons Information Centre, 112), even without any symptoms..

Ingestion

Rinse mouth carefully and spit out the water. Then drink at least half a litre of water, if possible with active carbon, and then induce vomiting. Contact Poison Information Centre (emergency number 112)..

B. Fire Fighting Information

Extinguishing Media

Carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Water must not be used for firefighting. Protective measures shall be taken with regard to the other material at the place of fire.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Chemical protection suit should be used in all rescue and sanitation work.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

Collect carefully and then transport it to a waste disposal establishment. Rinse with a large amount (50-100 volume parts) of water; Wipe up afterwards..

D. Storage And Handling

General Handling

Keep this product separated from groceries and out of reach of children and pets. Avoid contact with humans and animals and do not emit the product in a sensitive environment respectively.

Storage

Do not store above normal room temperature.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard for fatty acids, C14-18 and C16-18-unsaturated has not been established in Australia.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Breathing mask with filter B (grey) protecting against acid gases or dust filter IIb(P2) may be needed.

Hand Protection: Use appropriate allergy tested protection gloves.

Skin Protection: Protect all exposed skin that may come in contact with the product.

Eye protection: Not indicated.

Other Precautions: Working with dangerous substances shall be done in a fume cupboard or in else well ventilated places. Keep out of reach for children and pets.

F. Transport Information

Fatty acids, C14-18 and C16-18-unsaturated is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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FATTY ACIDS, C8-18 AND C18-UNSATURATED, ESTERS WITH PENTAERYTHRITOL

This dossier on fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database (using EC NO 285-202-9) that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

In an AICIS evaluation statement, fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol was determined to be a chemical that is unlikely to require further regulation to manage risks to the environment.[1]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): Fatty acids, C18-unsatd., mono- and diesters with neopentylglycol and di- and triesters with trimethylolpropane

CAS RN: 85049-33-8

Molecular formula: Not applicable, substance is a UVCB

Molecular weight: 577-927.5 g/mol

Synonyms: None

SMILES: Not applicable, substance is a UVCB

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Clear, yellow to amber organic liquid	2	ECHA
Melting Point	-18°C @ 101.3 kPa	2	ECHA
Boiling Point	>300°C @ 101.3 kPa, decomposition before boiling	-	ECHA
Density	920 kg/m^3 @ 20°C	2	ECHA
Vapour Pressure	<0.001 Pa @ 20°C	2	ECHA

[1] https://cdnservices.industrialchemicals.gov.au/statements/EVA00119%20-%20Evaluation%20Statement%20-%2026%20June%202023.pdf

Property	Value	Klimisch Score	Reference
Partition Coefficient (log K_{ow})	>7.64 (temperature not provided)	2	ECHA
Water Solubility	0.00001 g/L @ 20°C	2	ECHA
Flash Point	>200°C	2	ECHA
Auto flammability	Study scientifically not necessary	-	ECHA
Viscosity	27.6-35.42 mPa s @ 40°C	2	ECHA
Henry's Law Constant	Not relevant	-	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Fatty acids, C8-18 and C18-unsatd., esters with pentaerythritol are expected to have a low mobility in soil and sediment, however persistence in these compartments is not expected due to their ready biodegradability. The bioavailability is expected to be low.

B. Biodegradation

Fatty acids, C8-18 and C18-unsatd., esters with pentaerythritol is readily biodegradable based on read-across to similar fatty acids (CAS 68002-79-9, 68002-787-8 and 68541-50-4). Degradation in these studies conducted using OECD guidelines (301F and 301B) indicated degradation between 86% and 91% within 28 days (ECHA). [KI Score = 2].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

No experimental studies are available for fatty acids, C8-18 and C18-unsatd., esters with pentaerythritol. Using KOCWIN v2.00 with SMILES notations, log soil organic carbon partition coefficient (K_{oc}) values of 3.99 – 14.91 L/Kg (estimate with MCI method) were calculated. This result is supported by the read-across substance ester reaction products of fatty acid, C5-10, pentaerythritol and dipentaerythritol, resulting in a log K_{oc} of 4 - 7 L/Kg established in a guideline study according to OECD 121 under GLP conditions (ECHA). [KI Score = 2].

Based on these K_{oc} values, if released to soil, the substance is expected to moderately to strongly sorb to soil and have moderate to slight mobility. If released to water, based on these K_{oc} values and limited water solubility, the substance is expected to strongly sorb to suspended solids and sediments. Although they are expected to have a low mobility in soil and sediment, persistence in these compartments is not expected since the members of the category are readily biodegradable (ECHA).

D. Bioaccumulation

The bioavailability of fatty acids, C8-18 and C18-unsatd., esters with pentaerythritol is expected to be low. Though the polyols esters group has a high estimated log K_{ow} indicating the potential to bioaccumulate, significant accumulation is not expected based on the environmental fate of group members and expected rapid metabolisation of the substances. As fatty acids are naturally stored in

fat tissue and re-mobilized for energy production it can be concluded that even if they bioaccumulate, bioaccumulation will not pose a risk to living organisms. Fatty acids (typically C14 to C24 chain lengths) are also a major component of biological membranes as part of the phospholipid bilayer and therefore part of an essential biological component for the integrity of cells in every living organism (ECHA). [KI Score = 2].

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Information provided in the hazard assessment is based on members of the polyol esters category as outlined in ECHA.

The mechanism of the intestinal fat absorption has been studied with 14^C labelled fat in rats with the intestinal lymph duct cannulated. The results indicated that glycerides might be completely hydrolyzed in the intestinal lumen of the rat and then resynthesized in the intestinal wall. This class of materials had a low acute oral, dermal and inhalation toxicity potential. These materials are not irritating to the skin or eyes and showed no signs of being sensitisers. There were no / low observances of treatment-related effects in repeat dose oral, inhalation and dermal toxicity studies. Also, these materials were non-genotoxic in *in vitro* and *in vivo* models. And finally, there was no evidence of these materials causing reproductive or developmental toxicity.

B. Metabolism

The mechanism of the intestinal fat absorption has been studied with 14^C labelled fat in rats with the intestinal lymph duct cannulated. The proportions of neutral fat and phospholipids in the lymph were in all three cases about the same. 90% of the fatty acids were present in the neutral fat and the remaining 10 % in phospholipids. The neutral fat consisted chiefly of triglycerides; cholesterol and cholesterol esters representing only a minor part of this fraction. No free fatty acids or soaps appeared in the lymph. The results indicated that glycerides might be completely hydrolyzed in the intestinal lumen of the rat and then resynthesized in the intestinal wall (ECHA). [Kl. Score=2]

The absorbability of the fatty acid moiety of the complete, oleate esters of alcohols containing from one to six hydroxyl groups was determined by the fat balance technique in adult rats. Similarly, the absorbability of sucrose octaoleate and sucrose monooleate was determined. Absorption rates were between 0 and 100 %, depending on the amount of ester groups present in the substance fed. Pentaerythritole tetraoleate had an absorption rate of 90% (10% of dietary fat) and 64% (25% of dietary fat), respectively. Erythritole tetraoleate had an absorption rate of 72% (25% of dietary fat) (ECHA). [Kl. Score=2]

C. Acute Toxicity

Oral

An acute oral toxicity study was conducted in accordance with OECD 401 guidelines. Male and female rats (5 animals per sex) were exposed to 2000 mg/kg of 2,2-bis[(oleoyloxy)methyl]butyl octadec-9-enoate (CAS number 57675-44-2) by oral gavage. The animals were observed for 14 days for signs of toxicity. There were no deaths or treatment-related effects. The LD_{50} was >2000 mg/kg (ECHA). [Kl. Score=2]

Dermal

An acute dermal toxicity study was conducted in accordance with OECD 402 guidelines. Male and female rats were exposed nose-only to 5.22 mg/L of aerosolized fatty acids, C16-18 and C18-unsatd., branched and linear, esters with trimethylolpropane. The animals were exposed for 4 hrs and observed for the next 14 days for signs of toxicity. There were no deaths or treatment -related effects. The LD_{50} was >2000 mg/kg (ECHA). [Kl. Score=2]

Inhalation

An acute inhalation toxicity study was conducted in accordance with OECD 436 guidelines. Fatty acids, C16-18 and C18-unsatd., branched and linear, esters with trimethylolpropane (2000 mg/kg) was applied to the shave skin of male and female Sprague-Dawley rats. The animals were exposed for 24 hrs and observed for the next 14 days for signs of toxicity. There were no deaths or treatment -related effects. The LD_{50} was >5.33 mg/L (ECHA). [Kl. Score=2]

D. Irritation

Skin

An acute dermal irritation toxicity study was conducted in accordance with OECD 404 guidelines. Undiluted samples of fatty acids, C16-18, triesters with trimethylolpropane were applied to the shave skin of rabbits under semiocclusive conditions. The animals were exposed for 4 hrs and then observed for an additional 72 hrs for signs of irritation. All animals displayed very slight erythema at 24 hrs of exposure. In one case, erythema remained up to 48 hrs. The effects were fully reversible for all animals at 48 and 72 hrs of exposure. No oedema was seen. This material is not irritating to the skin (ECHA). [Kl. Score=2]

Eye

An acute eye irritation toxicity study was conducted in accordance with OECD 405 guidelines. Undiluted samples (0.1 ml) of fatty acids, C16-18 and C18-unsatd., branched and linear, esters with trimethylolpropane was instilled on to one eye of rabbits. The animals were exposed for 3 days (without washing). No corneal or iris effects occurred during the study with moderate conjunctival irritation observed in all animals at 1 hr of exposure. Minimal conjunctival irritation was noted in two treated eyes at 24 hr of exposure. The material is not irritating to the eyes (ECHA). [Kl. Score=2]

E. Sensitisation

Skin

A skin sensitisation study was conducted in accordance with OECD 406 guidelines. Male and female guinea pigs were exposed 5% 2,2-bis[(octanoyloxy)methyl]butyl decanoate by intradermal injection (Induction #1) and after 1 week, 100% of this material was applied by epicutaneous application (Induction #2). After Induction #2, 100% of the material was applied epicutaneously and observed for 14 days for signs of sensitization. There were no signs of sensitization at any point in the study attributable to treatment. Under the conditions of this study, this material was not a sensitiser (ECHA). [Kl. Score=2]

Inhalation

No data available

F. Repeated Dose Toxicity

Oral

A 90-day oral toxicity study was conducted in accordance with OECD 408 guidelines. Male and female Wistar rats (10 animals per sex per dose) were exposed to up to 1000 mg/kg bw/day of pentaerythritol ester of pentanoic acids and isononanoic acid by oral gavage for 90 days. There were no deaths at any dose and no effects on body weight change, food consumption or clinical signs. Also, there were no treatment-related ophthalmological, haematological or biochemical effects. Gross pathological and histopathological examination did not reveal any treatment- related effects. Under the conditions of this study, the no observed adverse effect level (NOAEL) was >1000 mg/kg bw/day (ECHA). [Kl. Score=2]

Inhalation

A 90-day inhalation toxicity study was conducted in accordance with OECD 413 guidelines. Male and female Sprague-Dawley rats (15 animals per sex per dose) were exposed daily by whole body to aerosolized pentaerythrityl tetra C5-9 acid esters. The animals were exposure for 13 weeks, 6 hours per day at 5 days per week to up to 0.56 mg/L of the test material. There were no deaths at any dose and no effects on body weight change, food consumption or clinical signs. Also, there were no treatment-related ophthalmological, haematological or biochemical effects. Gross pathological and histopathological examination did not reveal any treatment- relate effects. The following effects were considered treatment related: increased lung weight, mild macrophage accumulation in the lung at the high dose. Under the conditions of this study, the no observed adverse effect concentration (NOAEC) was 0.5 mg/L (ECHA). [Kl. Score=2]

Dermal

A 90-day dermal toxicity study was conducted in accordance with OECD 411 guidelines. Pentaerythrityl tetra C5-9 acid esters (800 or 2000 mg/kg bw) were applied daily to the shave skin of male and female Sprague-Dawley rats (10 animals per sex per dose). The animals were exposure for 13 weeks, at 24 hours per day at 5 days per week of the test material. There were no deaths at any dose and no effects on body weight change, food consumption or clinical signs. Also, there were no treatment-related ophthalmological, haematological or biochemical effects. Gross pathological and histopathological examination did not reveal any treatment- relate effects. The following effects were considered treatment related: slight erythemal and flaking, slight epidermal hyperplasia and chronic inflammation; reduction of body weight. Under the conditions of this study, the NOAEL was >2000 mg/kg bw/day (ECHA). [Kl. Score=2]

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on read across materials of fatty acids, C8-18 and C18-unsatd., esters with pentaerythritol are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on read across materials of Fatty acids, C8-18 and C18-unsatd., esters with pentaerythritol

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial Reverse Mutation Assay (OECD 471)[1]	-	-	2	ECHA
Mammalian Cell Gene Mutation Test (OECD 476; mouse lymphoma L5178Y cells)[2]	-	-	2	ECHA
Mammalian Chromosome Aberration Test (OECD 473; peripheral human lymphocytes)[3]	-	-	2	ECHA
Mammalian Chromosome Aberration Test (OECD 473; Chinese hamster ovary (CHO)[4]	-	-	2	ECHA

*+, positive; -, negative

1. Fatty acids, C14-18 and C18-unsatd., branched and linear, esters with trimethylolpropane
2. Fatty acids, C8-18 and C18-unsatd. triesters with trimethylolpropane
3. Fatty acids, C16-18 and C18-unsatd., branched and linear, esters with trimethylolpropane
4. 2,2-bis[(octanoyloxy)methyl]butyl decanoate

In Vivo Studies

An *in vivo* Mammalian Erythrocyte Micronucleus Test was conducted in accordance with OECD 474 with fatty acids, C5-10, esters with pentaerythritol. Male and female CD-1 mice were given single intraperitoneal injections of the test material (5000 mg/kg bw) and observed for up to 48 hrs for signs of toxicity. There were no statistically or biologically significant increases in the incidence of micronucleated polychromatic erythrocytes related to treatment. A small, but significant decrease was, however, noted in male mice treated with the test material at 5000 mg/kg bw. This small decrease is, however, considered not to be statistically significant compared to the concurrent control values. Under the conditions of this study, the test material was non-genotoxic (ECHA). [Kl. Score=2]

H. Carcinogenicity

Oral

No data available. There is no evidence that members of the polyol category cause carcinogenicity (ECHA).

Inhalation

No data available

Dermal

No data available

I. Reproductive Toxicity

No data available

J. Developmental Toxicity

Oral

The developmental toxicity of fatty acids C8-10, mixed esters with dipentaerythritol, isooctanoic acid, pentaerythritol and tripentaerythritol (CAS 189200-42-8) was investigated according to OECD Guideline 414 (prenatal developmental toxicity study) and under GLP conditions (Trimmer, 1995). 50 male Sprague-Dawley rats were mated with females to achieve groups of 25 pregnant Sprague-Dawley rats which then received daily oral gavage doses of the test substance at concentrations of 100, 500 and 1000 mg/kg bw/day during gestational days 6 to 15. Control animals received the vehicle polyethylene glycol (PEG 400). On day 21 of gestation the animals were euthanized and examined for maternal and foetal parameters. There were no adverse effects found for all parameters examined in maternal animals. Based on the number of implantations, number of total litter losses by resorption, mortality, clinical signs, body weight, gross pathology and organ weights of maternal animals the NOAEL for maternal toxicity was found to be 1000 mg/kg bw/day. Examination of foetus litter size and weights, offspring viability (number alive and number dead), sex ratio, grossly visible abnormalities, external, head, soft tissue and skeletal abnormalities showed only incidental malformations in two high dose females. The NOAEL for embryo-/fetotoxicity and teratogenicity in rats for fatty acids C8-10, mixed esters with dipentaerythritol, isooctanoic acid, pentaerythritol and tridipentaerythritol was found to be 1000 mg/kg bw/day (ECHA). [Kl. Score =2]

Inhalation

No data available

Dermal

Fatty acids, 8-10 (even numbered), di- and triesters with propylidynetrimethanol (CAS 11138-60-6) was tested in a prenatal developmental toxicity study comparable to OECD Guideline 414. The test substance was percutaneously applied to Sprague-Dawley rats for 6 h/day under occlusive conditions. 25 animals per sex per dose were treated with 200, 600 or 2000 mg/kg bw/day in corn oil on Days 6-15 of gestation. Control animals (25 per sex per dose) received the vehicle. The middle and the high dose levels caused some local irritation at the site of application, but no decreases in maternal weight gain or food consumption. There were no differences from control in any of the developmental parameters measured, including embryo/foetal viability, foetal weight, malformations, or variations. Therefore, a NOAEL of 2000 mg/kg bw/day was derived for prenatal development and for systemic maternal toxicity. Due to the irritation effects on skin, the local maternal NOAEL was found to be 200 mg/kg bw/day(ECHA). [Kl. Score =2]

The developmental toxicity of fatty acids, C5-9, tetraesters with pentaerythritol (CAS 67762-53-2) was investigated comparable to OECD Guideline 414 (prenatal developmental toxicity study). Groups of 15 presumed pregnant female Sprague-Dawley rats received daily dermal doses of the test substance at concentrations of 800 and 2000 mg/kg bw/day during gestational days 0 to 19. Control animals remained untreated. On day 20 of gestation the animals were euthanized and examined for maternal and foetal parameters. There were no adverse effects found for all parameters examined in maternal animals. Based on the number of implantations, number of total litter losses by resorption, mortality, clinical signs, body weight, gross pathology and organ weights of maternal animals the NOAEL for maternal toxicity was found to be 2000 mg/kg bw/day. Examination of foetus

litter size and weights, offspring viability (number alive and number dead), sex ratio, grossly visible abnormalities, external, head, soft tissue and skeletal abnormalities revealed no differences to controls and thus no indication for teratogenic effects. The only effect found was a dose-dependently increased number of foetuses with levocardia, although no hearth malformations have been detected. Furthermore, levocardia was observed in vehicle control foetuses and in the control foetuses conducted in the test laboratory. Since levocardia was observed in both treated groups, the NOAEL for embryo-/fetotoxicity and teratogenicity in rats fatty acids, C5-9, tetraesters with pentaerythritol was found to be < 800 mg/kg bw/day and the LOAEL = 800 mg/kg bw/day (ECHA). [Kl. Score =2]

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for fatty acids, C8-18 and C18-unsatd., esters with pentaerythritol to follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

Repeated dose oral toxicity studies resulted in NOAELs of 1000 mg/kg bw/day or greater in read-across group members. In a developmental toxicity study on fatty acids, 8-10 (even numbered), di- and triesters with propylidynetrimethanol (CAS 11138-60-6), due to the irritation effects on skin, the local maternal NOAEL was found to be 200 mg/kg bw/day. The NOAEL of 200 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

- UF_A (interspecies variability) = 10
- UF_H (intraspecies variability) = 10
- UF_L (LOAEL to NOAEL) = 1
- UF_{Sub} (subchronic to chronic) = 10
- UF_D (database uncertainty) = 1
- Oral RfD = 200/(10 x 10 x 1 x 10 x 1) = 200/1000 = 0.2 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

- Human weight = 70 kg (ADWG, 2011)
- Proportion of water consumed = 10% (ADWG, 2011)

Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.2 x 70 x 0.1)/2 = 0.7 mg/L

B. Cancer

There was no data available for the carcinogenic potential of fatty acids, C8-18 and C18-unsatd., esters with pentaerythritol. There is no evidence that members of the polyol category cause carcinogenicity. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Fatty acids, C8-18 and C18-unsatd., esters with pentaerythritol does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

While studies on the aquatic and terrestrial toxicity of fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol are not available, read-across studies with various triesters suggest low acute and chronic toxicity to aquatic organisms and low chronic toxicity to terrestrial organisms. No acute studies are available for terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

No acute studies are available for fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol. Table 3 lists the results of acute aquatic toxicity studies conducted on read-across group member triesters.

Table 3: Acute Aquatic Toxicity Studies on Read-Across Triesters

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Danio rerio (Zebrafish)	96-hr LC_{50}	>10,000 (triesters with propylidynetrimethanol [CAS 57675-44-2])	2	ECHA
Daphnia magna (Water flea)	48-hr LC_{50}	>100 (2,2-dimethyl-1,3-propanediyl dioleate [CAS 42222-50-4])	2	ECHA
Pseudokirchneriella subcapitata (Green alga)	72-hr EL_{50}	>110 (growth, triesters with trimethylolpropane)	2	ECHA

Chronic Studies

The available experimental studies on aquatic toxicity for all members of the polyol esters category and in particular for fatty acids, C16-18 (even numbered) and C16-18unsatd. (even numbered), mono-, diesters with neopentyl glycol and di-, triesters with trimethylolpropane (CAS 85186-92-1) show that on all three trophic levels no acute toxic effects up to the water solubility are to be expected. Furthermore, the available data on the long-term toxicity of aquatic invertebrates does not reveal adverse effects to daphnids. As there was no sign that fish is the most sensitive species in the short-term tests, it cannot be expected that a long-term test with fish will generate different results than the existing long-term test with invertebrates. Hence due to animal welfare reasons and to avoid unnecessary vertebrate tests, no further long-term test with fish is required and therefore data for fish was not reported (ECHA).

Table 4 lists the results of chronic aquatic toxicity studies conducted on invertebrates and algae for read-across triesters.

Table 4: Chronic Aquatic Toxicity Studies on Read-Across Triesters

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Daphnia magna (Water flea)	21-day NOELR	≥110 (triesters with trimethylolpropane [CAS 68002-78-8])	2	ECHA
Daphnia magna (Water flea)	15-day NOELR	≥2,570 (fatty acids, C8-10 [even numbered], di- and triesters with propylidynetrimethanol [CAS 11138-60-6])	2	ECHA
Desmodesmus subspicatus (Green alga)	72-hr NOEC	>100 (growth, triesters with propylidynetrimethanol [CAS 57675-44-2])	2	ECHA

C. Terrestrial Toxicity

No terrestrial studies are available for fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol.

Experimental data on the toxicity of read-across group members to terrestrial organisms are available for 2-ethyl-2-[[(1-oxoheptyl)oxy]methyl]propane-1,3-diyl bisheptanoate (CAS 78-16-0), fatty acids, C16-18 (even numbered) and C16-18-unsatd. (even numbered), triesters with trimethylolpropane (CAS 68002-79-9) and 2-ethyl-2-(((1-oxoisooctadecyl)oxy)methyl)-1,3-propanediyl bis (isooctadecanoate) (CAS 68541-50-4).

The long-term toxicity of 2-ethyl-2-[[(1-oxoheptyl)oxy]methyl]propane-1,3-diyl bisheptanoate (CAS 78-16-0) and 2-ethyl-2-(((1-oxoisooctadecyl)oxy)methyl)-1,3-propanediyl bis (isooctadecanoate) (CAS 68541-50-4) to earthworms was tested in two studies according to OECD guideline 222. The studies focused on the effect of the test substances on earthworm survival, growth and reproduction. Mortality or detrimental effects on earthworm growth were not observed and thus a

NOEC (28 d) ≥ 1000 mg/kg soil dw based on mortality. The reproduction rate was determined after another 28 days by counting the number of hatched juveniles. A significant difference to the control was not observed and thus a NOEC (56 d) ≥ 1000 mg/kg was determined based on reproduction (ECHA). [Kl. Score=2]

The short-term toxicity of fatty acids, C16-18 (even numbered) and C16-18-unsatd. (even numbered), triesters with trimethylolpropane (CAS 68002-79-9) was tested according to OECD 208. The study determined no toxicity of the TMP ester on the early seedling growth of the tested plant species (NOEC (14 d) = 300 mg/kg for *Lycopersicon esculentum* and *Raphanus sativus* respectively, NOEC (14 d) = 1000 mg/kg for *Avena sativa*) (ECHA). [Kl. Score=2].

Generally, the available data on the members of the group indicate a low bioavailability and a low toxicity of the substances to terrestrial organisms (ECHA).

D. Calculation of PNEC

The PNEC calculations for fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol follow the methodology discussed in DEWHA (2009).

PNECs were not calculated for fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol. These fatty acids are readily biodegradable and have a low potential to bioaccumulate. Aquatic toxicity data indicate no adverse effects up to their water solubility limits (< 1 mg/L). Further, they pose a low risk to the sediment and soil compartment.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol are readily biodegradable. Thus, they do not meet the screening criteria for persistence.

The bioavailability of fatty acids, C8-18 and C18- unsaturated, esters with pentaerythritol is expected to be low. Though the polyols esters group has a high estimated log K_{ow} indicating the potential to bioaccumulate, significant accumulation is not expected based on the environmental fate of group members and expected rapid metabolisation of the substances. Thus, fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol do not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol are > 0.1 mg/L. The acute E(L)C_{50} values from the acute aquatic toxicity studies on fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol are > 1 mg/L. Thus, fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol do not meet the criteria for toxicity.

The overall conclusion is that fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol are not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Not classified

B. Labelling

No signal word

C. Pictogram

None

X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

Rinse immediately carefully and thoroughly with eye-bath or water.

Skin Contact

Wash immediately with water.

Inhalation

No special measures are necessary.

Ingestion

Rinse mouth immediately and drink plenty of water.

B. Fire Fighting Information

Extinguishing Media

Carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

None.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus. Wear fully protective suit. Do not breathe fumes from the fire.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

In case of solid product, avoid the dust release. In case of liquid product, limit and adsorb the spill with inert adsorbing material (for example sand, vermiculite). Put the resultant material in adequate packaging and send to an authorized plant for the disposal. Collect the spread product and then wash the contaminated area should be cleaned up immediately with water. Recover the water used and send to an authorized plant for the disposal. .

D. Storage And Handling

General Handling

Wear suitable protective equipment. Handle in accordance with good industrial hygiene rules.

Storage

Only use containers specifically approved for the substance/product. Keep container tightly closed and in a dry and well-ventilated place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard for fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol has not been established in Australia.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Carry along escape equipment (self-rescuer).

Hand Protection: Protective gloves (EN 374 Chemical Risk) are required. The glove material has to be impermeable and resistant to the product/substance/preparation. Gloves must be of suitable materials with direct and prolonged contact (recommended: protection index 6 corresponding to> 480 minutes permeation time as per EN 374): e.g. nitrile rubber (0.4 mm), chloroprene rubber (0.5 mm), polyvinylchloride (0.7 mm) and other. .

Skin Protection: Body protection must include protective clothing to prevent the inflammation and irritation of the skin of the neck and wrists through such contact with the powder or small quantities. The body protection must be suitable depending on activity and possible exposure, e.g. apron, boots and suitable for contact with chemical agents (according to EN14605 in case of splashes or EN ISO 13982 in case of dust)..

Eye protection: Safety glasses with side-shields.

F. Transport Information

Fatty acids, C8-18 and C18-unsaturated, esters with pentaerythritol is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

Australian Drinking Water Guidelines [ADWG]. (2011). National Water Quality Management Strategy. Australian Drinking Water Guidelines, Section 6, Australian Government, National Health and Medical Research Council, Natural Resource Management Ministerial Council. Updated June 2025. https://www.nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines

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Industrial Chemicals Environmental Management Standard [IChEMS]. (2022). Australian Environmental Criteria for Persistent, Bioaccumulative and/or Toxic Chemicals. https://www.dcceew.gov.au/sites/default/files/documents/australian-pbt-criteria.pdf

Klimisch, H.J., Andreae, M., and Tillmann, U. (1997). A systematic approach for evaluating the quality of experimental and toxicological and ecotoxicological data. Regul. Toxicol. Pharmacol. 25:1-5.

GRAPHITE (CAS RN 7782-42-5)
CARBON (CAS RN 7440-44-0)
CARBON BLACK (CAS RN 1333-86-4)

This dossier on graphite, carbon and carbon black presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam and shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Graphite, carbon and carbon black are classified as **tier 1** chemicals and requires a hazard assessment only.

1 BACKGROUND

Graphite is a naturally-occurring form of crystalline carbon. It is a native element mineral found in metamorphic and igneous rocks. It is extremely soft, cleaves with very light pressure, and has a very low specific gravity. In contrast, it is extremely resistant to heat and nearly inert in contact with almost any other material.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): graphite

CAS RN: 7782-42-5

Molecular formula: [C]

Molecular weight: 12.011 g/mol

Synonyms: graphite; black lead

Chemical Name (IUPAC): carbon black

CAS RN: 1333-86-4

Molecular formula: [C]

Molecular weight: 12.011 g/mol

Synonyms: carbon black; acetylene black

Chemical Name (IUPAC): methane

CAS RN: 7440-44-0

Molecular formula: [C]

Molecular weight: 12.011 g/mol

Synonyms: carbon; elemental carbon; carbon 12

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for representative group member graphite are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Graphite

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Odourless black solid powder	1	ECHA
Melting Point	600°C @ 101.3 kPa	1	ECHA
Boiling Point	Study not necessary according to Annex VII column II REACH-Regulation for substances with a melting point higher than 300°C.	-	ECHA
Density	2214 kg/m^3 @ 25°C	1	ECHA
Vapor Pressure	Study not necessary according to Annex VII column II REACH-Regulation for substances with a melting point higher than 300°C.	1	ECHA
Partition Coefficient (log K_{ow})	Study not necessary according to Annex VII column II REACH-Regulation for inorganic substances.	1	ECHA
Water Solubility	0 g /L @ 25°C (insoluble)	1	ECHA
Dissociation Constant (pKa)	Not Applicable	-	ECHA
Viscosity	The study is technically not feasible because the OECD test guideline No. 114 is applicable to liquids only.	1	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for graphite, carbon black or carbon.

NICNAS has assessed graphite and carbon in Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that they pose no unreasonable risk to the environment.[1][2]

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Members of this group are inorganic substances that are not subject to biodegradation. They are not expected to bioaccumulate; and, being chemically inert and insoluble, adsorption is not relevant.

B. Biodegradation

Group members are inorganic substances. According to Annex VII of the REACH regulations, biodegradation testing for inorganic chemicals is not required.

C. Environmental Distribution

No value for the adsorption /desorption is given due to the technical infeasibility to detect the substances in the solvents used for the test (ECHA).

D. Bioaccumulation

A bioaccumulation study is technically not feasible according to REACH Annex XI, point 2. Based on their physicochemical properties, it can be concluded that these substances are devoid of any bioaccumulation potential.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Group members are of low acute and chronic toxicity concern to aquatic and terrestrial organisms.

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=d0e3433e-f36b-1410-8e4e-00f1fcf8411a
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=d363433e-f36b-1410-8de4-00e8f2afc108

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on group member graphite.

Table 3 Acute Aquatic Toxicity Studies on Graphite

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Danio rerio	96-hour LC_{50}	>100	1	ECHA
Daphnia magna	48-hour EC_{50}	>100	1	ECHA
Raphidocelis subcapitata	72-hour EC_{50}	>100	1	ECHA

Chronic Studies

There are no chronic studies for fish or invertebrates. Due to the known inherent physico-chemical properties of graphite and the absence of acute toxic effects, there is no indication for harmful long-term effects arising from exposure to graphite or group members carbon and carbon black.

The72-hour NOEC for *Raphidacelis subcapitata* is > 100 mg/L for graphite (ECHA) [KI Score 1].

C. Terrestrial Toxicity

No data are available. Due to the absence of toxicity data for soil organisms, the equilibrium partitioning method was applied to assess the hazard to soil organisms. Valid available data on acute aquatic toxicity show that graphite is not toxic up to the tested loading rate of 100 mg/L. No sublethal effects were observed. Graphite is not identified to be hazardous to the aquatic environment. Following the principles of the equilibrium-partitioning method, this hazard conclusion is extrapolated to the soil compartment. Therefore, no further testing on long-term toxicity to terrestrial organisms is considered to be required (ECHA).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Graphite, carbon and carbon black are inorganic minerals. Thus, biodegradation is not applicable to these substances. For the purposes of this PBT assessment, the persistent criteria are not considered applicable.

OECD test guideline 305 on bioaccumulation in fish is applicable to chemical substances for which it is possible to generate stable solutions in water. Graphite, carbon and carbon black, however, are completely insoluble in water. In view of their insolubility, there is no bioaccumulation potential under realistic natural conditions.

NOECs from the chronic aquatic toxicity study in algae on graphite are >0.1 mg/L. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies on graphite are >1 mg/L. Thus, graphite and group members carbon and carbon black do not meet the screening criteria for toxicity.

The overall conclusion is that graphite, carbon and carbon black are not PBT substances.

B. Other Characteristics of Concern

No other characteristics of concern were identified for graphite, carbon or carbon black.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Graphite	7782-42-5	Not a PBT	No	No	NA	No	No	No	1	1	1
Carbon	7440-44-0	Not a PBT	No	No	NA	No	No	No	1	1	1
Carbon black	1333-86-4	Not a PBT	No	No	NA	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

European Chemicals Agency [ECHA]. ECHA REACH database: http://echa.europa.eu/information-on-chemicals/registered-substances

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Klimisch, H.J., Andreae, M., and Tillmann, U. (1997). A systematic approach for evaluating the quality of experimental and toxicological and ecotoxicological data. *Regul. Toxicol. Pharmacol. 25*:1–5.

B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
g/mol	grams per mole
GLP	Good Laboratory Procedures
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg/m^3	kilograms per cubic metre
kPa	kilopascal
LC	lethal concentration
mg/L	milligrams per litre
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NOEC	no observed effective concentration
OECD	Organisation for Economic Co-operation and Development
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases

EHS Support

HEXAMETHYLENEDIAMINE

This dossier on hexamethylenediamine (HMD) presents the most critical studies pertinent to the risk assessment of HMD in its use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – HMD is classified as a tier 1 chemical and requires a hazard assessment only.

1 BACKGROUND

HMD is an aliphatic amine that is a colourless to white mass crystallised solid at ambient temperatures; however, it is typically handled in industrial applications as a liquid (ECHA).

HMD is readily biodegradable. It is not expected to bioaccumulate, and accumulation in soil or sediment is not expected. HMD exhibits low acute and chronic toxicity to aquatic organisms. Terrestrial toxicity is not of concern.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): hexane-1,6-diamine

CAS RN: 124-09-4

Molecular formula: $C_6H_{16}N_2$

Molecular weight: 116.20 g/mol

Synonyms: hexamethylenediamine; 1,6-hexanediamine; 1,6-diaminohexane; 1,6-diaminohexamethylene; 1,6-hexamethylenediamine

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Hexamethylenediamine

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Colourless to white crystallized mass	2	ECHA
Melting Point	36-43°C @ 101.3 kPa:	2	ECHA
Boiling Point	201°C @ 101.3 kPa	2	ECHA
Density	978 kg/m³ @ 20°C	1	ECHA

Property	Value	Klimisch Score	Reference
Vapor Pressure	1000 Pa @ 78.5°C	1	ECHA
Partition Coefficient (log K_{ow})	0.4 (nonionised form, at pH >= 13)	1	ECHA
Dissociation Constant (pKa)	Not expected to occur	-	ECHA
Water Solubility	637 g/L@ 20°C	1	ECHA
Viscosity	Not applicable, substance is a solid at room temperature	-	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for HMD.

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

HMD is readily biodegradable. It is not expected to bioaccumulate, and accumulation in soil or sediment is not to be expected.

B. Partitioning

HMD is highly soluble in water. Volatilization from water or moist soil surfaces is not expected to be an important fate process based upon its Henry's Law Constant (3.26×10^{-4} Pa m^3/mol). It is also not expected to volatilize from dry soil surfaces based upon its estimated vapour pressure.

C. Biodegradation

HMD is readily biodegradable. In an OECD 301D closed bottle test, there was 40% degradation after 7 days, 74% after 14 days, and 82% after 28 days (ECHA) [Kl. Score = 1]. If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

D. Environmental Distribution

While HMD is highly hydrophilic (log P_{ow} <=0.4) and does not show surface active properties, aliphatic amines are strong bases and are protonated at environmental pH and, in consequence, due to the positive charge are prone to bind on negatively charged solid matter. This is demonstrated by the results from the available adsorption-desorption study (OECD 106): The bifunctional aliphatic amine HMD (2 amino groups) is capable to bind to soil and, to a lower level, sediment. The soil organic carbon partition coefficient (K_{oc}) for HMD was calculated to be between 14 L/kg and 714 L/kg. Binding was not a function of organic carbon content of the soils. Rather, clay and silt content might be decisive. Desorption was observed and was considerable, but the extent of desorption declined over time. Due to the observed rapid mineralization, accumulation in soil or sediment is not to be expected. (ECHA). [Kl. score = 1]

E. Bioaccumulation

In accordance with column 2 of Annex IX 9.3.2 of REACH Regulation EC 1907/2006 (ECHA), bioaccumulation testing in aquatic species is not required as the substance has a low potential for bioaccumulation (log K_{ow} of < 3).

The log K_{ow} for HMD is 0.4. Thus, HMD is not expected to bioaccumulate.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

HMD exhibits low acute and chronic toxicity to aquatic organisms. Terrestrial toxicity is not of concern.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies on salts of hexamethylenediamine.

Table 3 Acute Aquatic Toxicity Studies on hexamethylenediamine

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Pimephales promelas	96-hr LC_{50}	1,825	2	ECHA
Daphnia magna	48-hr EC_{50}	31.5 (geometric mean)	2	ECHA
Raphidocelis subcapitata	72-hr EC_{50}	>100	1	ECHA

Chronic Studies

Chronic data of good reliability from international guidelines are available for algae and invertebrates. The lowest value is a NOEC of 4.2 mg/L based on a 21-day reproduction test on daphnids performed according to the OECD 211 Guideline (ECHA) [Kl. Score = 4]. A chronic fish study has been waived due to the much lower sensitivity of this trophic level compared to the daphnid data.

C. Terrestrial Toxicity

Terrestrial toxicity of the submission substance was analysed with regard to earthworm reproduction according to OECD 222 and ISO 11268-2 (Part 2), compliant with GLP (RL 1). The earthworm *Eisenia fetida* (*Lumbricidae*) was chosen as a representative of the soil fauna.

The EC_{10} was calculated as 176.1 mg test item/kg soil (dw) (95% Confidence limits (CL) = 151.0 – 202.3 mg test item/kg soil (dw)).

The EC_{50} was calculated as 441.9 mg test item/kg soil (dw) (95% CL = 414.3 – 475.3 mg test item/kg soil (dw)).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

HMD is readily biodegradable; therefore, it does not meet the screening criteria for persistence.

The log K_{ow} for HMD is 0.4. Thus, HMD does not meet the screening criteria for bioaccumulation.

The NOEC values from chronic aquatic toxicity studies on HMD is >0.1 mg/L. The acute aquatic toxicity $E(L)C_{50}$ values for HMD are > 1 mg/L. Thus, HMD does not meet the screening criteria for toxicity.

The overall conclusion is that HMD is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for HMD.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Hexamethylenediamine	124-09-4	Not a PBT	No	No	No	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

Department of the Environment and Energy [DoEE]. (2017). *Chemical Risk Assessment Guidance Manual: for chemicals associated with coal seam gas extraction*. Guidance manual prepared by Hydrobiology and ToxConsult Pty Ltd for the Department of the Environment and Energy, Commonwealth of Australia, Canberra. Available: https://www.dcceew.gov.au/water/coal-and-coal-seam-gas/national-assessment-chemicals/consultation-risk-assessment-guidance-manual

European Chemicals Agency [ECHA]. ECHA REACH database. http://echa.euroa.eu/information-on-chemicals/registered-substances

European Chemicals Agency [ECHA]. (2023). Chapter R.11: vPvB assessment. In *Guidance on information requirements and chemical safety assessment*. Version 4.0. https://echa.europa.eu/guidance-documents/guidance-on-information-requirements-and-chemical-safety-assessment

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Klimisch, H.J., Andreae, M., and Tillmann, U. (1997). A systematic approach for evaluating the quality of experimental and toxicological and ecotoxicological data. *Regul. Toxicol, Pharmacol. 25*:1–5.

B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg/m^3	kilograms per cubic metre
kPa	kilopascal
LC	lethal concentration
mg/L	milligrams per litre
NOEC	no observed effect concentration
OECD	Organisation for Economic Co-operation and Development
PBT	Persistent Bioaccumulative Toxic

REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
ThOD	Theoretical oxygen demand

HEXYLENE GLYCOL

This dossier on hexylene glycol presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): 2-methylpentane-2,4-diol

CAS RN: 107-41-5

Molecular formula: $C_6H_{14}O_2$

Molecular weight: 118.176 g/mol

Synonyms: hexylene glycol; 2,4-dihydroxy-2-methylpentane; Diolane

SMILES: CC(O)CC(C)(C)O

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of hexylene glycol

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Liquid	2	ECHA
Melting Point	-50°C @ 101.3 kPa	2	ECHA
Boiling Point	197°C @ 101.3 kPa	2	ECHA
Density	923 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	6.66 Pa @ 25°C	2	ECHA
Partition Coefficient (log K_{ow})	0 @ 20°C	2	ECHA
Water Solubility	68.8 g/L @ 25°C	2	ECHA
Flash Point	93°C	2	ECHA
Auto flammability	306°C	2	ECHA
Viscosity	34 mPa s @ 20°C	2	ECHA
Henry's Law Constant	Not available	-	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Hexylene glycol is readily biodegradable. It is not expected to bioaccumulate. It has a low potential to adsorb to soil or sediment.

B. Biodegradation

Hexylene glycol is readily biodegradable. In an activated sludge study under aerobic conditions, there was 81% degradation after 28 days, as determined by oxygen consumption (ECHA) [Kl.. Score = 1].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

No experimental studies were available. Based on an estimated soil organic carbon partition coefficient (K_{oc}) value of 1 L/kg, hexylene glycol has a low potential to adsorb to soil. If released to water, based on this K_{oc} value and its water solubility, it is expected to preferentially partition to the water column.

D. Bioaccumulation

No experimental studies were available. Based on a log K_{ow} of zero, hexylene glycol has low potential for bioaccumulation (ECHA).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Hexylene glycol is noted to be a low hazard from acute/short term exposures. It may be slightly irritating to eyes, but it is not irritating to the skin or respiratory tract. It is not a skin sensitiser. No systemic effects were observed in repeat dose toxicity studies. The substance is not genotoxic and is not reported to be mutagenic or carcinogenic. It is not a reproductive or developmental toxicant.

B. Metabolism

Hexylene glycol is moderately (~50%) absorbed through the gastrointestinal tract upon ingestion with less absorption through dermal exposures. Little data are available for absorption and toxicokinetics of hexylene glycol via inhalation exposures. Upon ingestion, about 35% of the compound is excreted in the urine as unchanged hexylene glycol or the metabolite glucuronide (ECHA).

Oral

A single administration of hexylene glycol in corn oil in Sprague-Dawley rats at a concentration of 590 mg/kg. Plasma concentrations of free hexylene glycol were measured at multiple time points after treatment. The half-life of hexylene glycol after oral administration is estimated to be longer than 6 hours, with the mean plasma concentrations peaking at 1.5 hours (hrs). No death or clinical signs were observed (ECHA). [Kl. Score = 2]

A milk transfer study was conducted on Female Sprague-Dawley rats orally gavaged at a dose of 1000 milligrams per kilogram body weight per day (mg/kg-bw/day) with hexylene glycol through days 20 or 21 post coitum and one the first day post-partum. Both milk and pups were evaluated and found small amounts (about 3%) of the maternal dose of hexylene glycol is transferred to the pup via milk transfer (ECHA). [Kl. Score = 1]

Dermal

An OECD Guideline 428 (Skin Absorption: In Vitro Method) test was conducted on human dermatoned skin to determine the absorption hexylene glycol. After 24 hours of exposure, only a small percentage (2.6% with a range of 1.1-5.3%) of the compound was absorbed (ECHA). [Kl. Score = 1]

C. Acute Toxicity

Oral

An OECD Guideline 420 (Acute Oral Toxicity – Fixed Dose Method) test was conducted in male and female Crl:CD rats orally gavaged with a single dose of hexylene glycol at 2000 milligrams per kilograms body weight (mg/kg-bw). Clinical signs were records on day 1 and observations continued for 15 days post treatment. Clinical signs (ataxia, decreased activity) were observed but resolved by day 2. No mortality or permanent signs of toxicity were observed through the observation period. The LD0 for hexylene glycol is 2000 mg/kg-bw for oral toxicity (ECHA). [Kl. Score = 1].

Inhalation

The acute inhalation toxicity of hexylene glycol was evaluated following OECD Guideline 403 in an unspecified strain of male rats exposed for 8 hrs to hexylene glycol in a saturated atmosphere (estimated to be about 60 millilitres per cubic meter of air (mL/m^3)). No mortality or other clinical signs were observed. Therefore, the inhalation LD0 for hexylene glycol was determined to be a saturated atmosphere (ECHA). [Kl. Score = 2]

Dermal

In an acute dermal toxicity study following OECD Guideline 402 (Acute Dermal Toxicity) and EU Method B.3, male and female Crl:CD rats were exposed to a concentration of 2000 mg/kg-bw hexylene glycol for 24 hours on a patch 10% of the total body surface. No mortality or observable dermal changes, such as signs of irritation, were observed for 15 days following application of hexylene glycol. Therefore, the LD0 for dermal exposure to hexylene glycol is >2000 mg/kg-bw (ECHA). [Kl. Score = 1]

D. Irritation

Skin

An OECD Guideline 404 (Acute Dermal Irritation)/EU Method B.4 test was conducted on three New Zealand White rabbits exposed to 0.5 mL of undiluted hexylene glycol for four hours. Clinical observations for dermal irritation were conducted at 1, 24, 48 and 72 hrs post exposure and finally on day 5. Slight irritation (as erythema) was observed in two of the rabbits which absolved completely by day 5. No other clinical findings were noted. Based on this study, hexylene glycol is not classified as irritating to the skin (ECHA). [Kl. Score = 1]

Eye

In an OECD Guideline 405 (Acute Eye Irritation/Corrosion)/EU Method B.5 test, 0.1 mL of undiluted hexylene glycol was applied to three White New Zealand rabbits and clinicals findings recorded 0.5, 1, 4, 24, 48, 72 hrs and 7 days after exposure. All test subjects developed signs of irritation (corneal and conjunctival irritation, chemosis) that resolved after four days and were not observed at the end of the observation period (7 days). Based on this study, hexylene glycol is identified as slightly irritating to the eye [Kl. Score = 1]

E. Sensitisation

In an OECD Guideline 406 (Skin Sensitization)/EU Method B.6 test, ten male and ten female Dunkin-Hartley guinea pigs were exposed to hexylene glycol via six intradermal injections to induce sensitisation followed by one dermal application to test for sensitization following induction. Clinical observations for evidence of skin sensitisation (as irritation) were conducted at 1, 24 and 48 hours following the sensitisation application. No localized skin sensitisation was observed during any observation period. Based on this study, hexylene glycol is not classified as a skin sensitiser (ECHA). [Kl. Score = 1]

F. Repeated Dose Toxicity

Oral

An OECD Guideline 408 (Repeated Dose 90-Day Oral Toxicity Study in Rodents) test was conducted on male and female Sprague-Dawley rats orally gavaged with hexylene glycol at doses of 50, 150, and 450 mg/kg-bw/day for 13 weeks. Aside from some reversible effects (local irritation to stomach and forestomach), no mortality or other systemic effects were observed. Based on this study, a NOAEL of 450 mg/kg-day is identified for hexylene glycol (ECHA). [Kl. Score = 1]

Inhalation

No inhalation toxicity studies are available for hexylene glycol.

Dermal

No dermal toxicity studies are available for hexylene glycol.

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on hexylene glycol are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on hexylene glycol

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay) (*Salmonella typhimurium TA1538, TA1537, TA98, TA100*)	-	-	2	ECHA

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 473 equivalent (*In vitro* Mammalian Chromosome Aberration Test) (Chinese hamster ovary (CHO))	-	-	1	ECHA
OECD Guideline 476 equivalent (*In vitro* Mammalian Cell Gene Mutation Test) (mouse lymphoma L5178Y cells)	-	-	1	ECHA

*+, positive; -, negative

In Vivo Studies

No studies available.

H. Carcinogenicity

No studies available.

I. Reproductive Toxicity

An OECD Guideline 443 (Extended One-Generation Reproductive Toxicity) test was conducted on male and female Wistar rats orally gavaged with hexylene glycol at doses of 100, 250 and 800 mg/kg-bw/day for one (F0 and F1) generation. F0 animals were treated for two weeks prior to mating and until litters were 28 days old. F1 animals were treated from weaning until termination at 13 weeks (cohort 1A) and through pairing, gestion, and lactation of F2 generation pups. In general, mortality and systemic toxicity was not observed in any generation (F0, F1 cohorts 1A and 1B), however in both the F1 and F2 generations, a decrease in viability at birth was observed at the highest test dose (800 mg/kg-bw/day). In addition, clinical parameters indicating altered kidney function was observed at 250 mg/kg-bw/day in the F0 parental generation. Based on this study, NOAELs of 250 mg/kg-day for reproductive effects and 100 mg/kg-day for urinary effects are identified for hexylene glycol (ECHA). [Kl. Score = 1]

J. Developmental Toxicity

Two OECD Guideline 414 (Prenatal Developmental Toxicity Study) development studies have been conducted for hexylene glycol. In a study of 25 time-mated New Zealand White rabbits, test subjects were orally gavaged with hexylene glycol at doses of 80, 250, and 600 mg/kg-bw from day 6 to day 28 post coitum. Although some maternal (body weight gain) and embryofetal parameters (delayed skeletal ossification) were observed at the 250 mg/kg-bw/day dose. Based on this study, a NOAEL of 600 mg/kg-bw is identified for development effects of hexylene glycol (ECHA). [Kl. Score = 1]

In the second study, Crl:CD(SD)BR rats were orally gavaged with hexylene glycol at doses of 30, 300, and 1000 mg/kg-bw from day 6 to day 15 of the gestation period. Some maternal (body weight gain) and embryofetal parameters (delayed skeletal ossification) were observed at the 300 mg/kg-bw/day dose, however the foetal effects were related to the decrease in maternal body weight and not identified as a teratogenic effect from hexylene glycol itself. Based on this study, a NOAEL of 1000 mg/kg-bw is identified for development effects of hexylene glycol (ECHA). [Kl. Score = 1]

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for hexylene glycol follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

~~Oral~~

A subchronic reproductive study of hexylene glycol in drinking water in rat identified a NOAEL of 100 mg/kg-bw in female rats. The NOAEL from this study is based on no effect for urinary/kidney effects. This NOAEL will be used to derive an oral reference dose and drinking water guideline value for hexylene glycol.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 100/(10 x 10 x 1 x 10 x 1) = 100/1000 = 0.1 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.1 x 70 x 0.1)/2 = 0.35 mg/L

B. Cancer

No studies were available for the carcinogenicity of hexylene glycol. Thus, a cancer reference value for the substance was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Hexylene glycol does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Hexylene glycol is expected to have low acute and chronic toxicity to aquatic organisms. Hexylene glycol is expected to have low chronic toxicity to terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on hexylene glycol.

Table 3: Acute Aquatic Toxicity Studies on Hexylene Glycol

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Gambusia affinis (Mosquitofish)	96-hr LC_{50}	8,510 – 9,910	2	ECHA
Pimephales promelas (Fathead minnow fish)	96-hr LC_{50}	8,690	2	ECHA
Lepomis macrochirus (Bluegill fish)	96-hr LC_{50}	12,800	2	ECHA
Oncorhynchus mykiss (Rainbow trout)	96-hr LC_{50}	9,450	2	ECHA
Ictalurus punctatus (Channel catfish)	96-hr LC_{50}	11,200 – 13,500	2	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	5,410	2	ECHA
Raphidocelis subcapitata (Green algae)	72-hr EC_{50}	>429 (growth)	1	ECHA

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on hexylene glycol.

Table 4: Chronic Aquatic Toxicity Studies on Hexylene Glycol

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Danio rerio (Zebra fish)	34-day NOEC	≥13.7	1	ECHA
Daphnia magna (Water flea)	21-day NOEC	≥105	1	ECHA

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Raphidocelis subcapitata (Green algae)	72-hr NOEC	429 (growth)	1	ECHA

C. Terrestrial Toxicity

Two chronic terrestrial studies on microorganisms are available for hexylene glycol. In a study using OECD Guideline 216, the 28-day NOEC was 97.7 mg/kg dw based on reproduction (ECHA) [Kl. Score = 1]. In another study using OECD Guideline 217, the 28-day NOEC was >1,000 mg/kg dw based on respiration rate (ECHA) [Kl. Score =1].

D. Calculation of PNEC

The PNEC calculations for hexylene glycol follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (8,510 mg/L), invertebrates (5,410 mg/L), and algae (>429 mg/L). NOEC values from long-term studies are available for fish (≥13.7 mg/L), invertebrates (≥105 mg/L) and algae (429 mg/L). On the basis that the data consists of short-term and long-term results from three trophic levels, an assessment factor of 10 has been applied to the lowest reported NOEC value of ≥13.7 mg/L for fish. The $PNEC_{water}$ is 1.37 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 0.88 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (0.82/1280) \times 1000 \times 1.37$
$= 0.88$ mg/kg

Where:

$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 0.04/1000 \times 2400]$
$= 0.82\ m^3/m^3$

Where:

Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
$= 1 \times 0.04$
$= 0.04$ L/kg

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The estimated K_{oc} for hexylene glycol is 1 L/kg.

F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are limited toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 0.018 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$

$= (0.02/1500) \times 1000 \times 1.37$

$= 0.018$ mg/kg

Where:

Kp_{soil} = soil-water partition coefficient (m^3/m^3)

BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]

$Kp_{soil} = K_{oc} \times f_{oc}$

$= 1 \times 0.02$

$= 0.02\ m^3/m^3$

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The estimated K_{oc} for hexylene glycol is 1 L/kg.

F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Hexylene glycol is readily biodegradable and thus does not meet the screening criteria for persistence.

Based on a measured log K_{ow} of 0 L/Kg, hexylene glycol does not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on hexylene glycol are > 0.1 mg/L. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies on hexylene glycol are > 1 mg/L. Thus, hexylene glycol does not meet the criteria for toxicity.

The overall conclusion is that hexylene glycol is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Skin Irrit. Category 2, H315

Eye Irrit. Category 2, H319

B. Labelling

Warning

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Skin Contact

Remove contaminated clothes. Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical. Water or foam may cause frothing but are still acceptable media.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment including a filter respirator for organic gases and vapours. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place. Keep separated from strong oxidants and strong acids.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

The workplace exposure standard for hexylene glycol in Australia is as follows: time weighted average (Peak limitation) 121 mg/m^3.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Methylpentanes are considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code of Class 3 UN No1208 is required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations. Important to consider the material's impact on air quality, potential migration in soil or water, effects on animal and lant life and conformance with environmental and public health regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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IRON OXIDE

This dossier on iron oxide presents the most critical studies pertinent to the risk assessment of iron oxide in its use in coal seam gas extraction activities. It does not represent an exhaustive or critical review of all available data. The information presented in this dossier was obtained primarily from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Iron oxide is classified as a tier 1 chemical and requires a hazard assessment only.

1 BACKGROUND

Iron oxide is an inorganic compound. It is partially soluble in water, dissociating into iron and hydroxyl ions; both are ubiquitous in the environment. The ions will not adsorb on particulate matter or surfaces and will not accumulate in living tissues. Iron oxide is of low toxicity concern to aquatic and terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): diiron(3+) trioxidandiide

CAS RN: 1309-37-1

Molecular formula: Fe_2O_3

Molecular weight: 177.7 g/mol

Synonyms: Hydrous ferric oxide, Iron oxide (Fe_2O_3), hydrate iron (III) oxide monohydrate, Iron oxide (Fe_2O_3), hydrate

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Iron Oxide

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Red, crystalline, odorless solid	2	ECHA
Melting Point	1,565°C @ 101.3 kPa	2	ECHA
Boiling Point	In accordance with REACH Annex VII (ECHA), the study does not need to be conducted, as the substance has a melting point > 300°C.	1	ECHA
Density	5,250 kg/m^3 @ 25°C	2	ECHA

Property	Value	Klimisch Score	Reference
Vapor Pressure	In accordance with column 2 of REACH Annex VII (ECHA), the study does not need to be conducted, as the substance has a melting point above 300°C.	-	ECHA
Partition Coefficient (log K_{ow})	In accordance with column 2 of REACH Annex VII (ECHA), the study does not need to be conducted as the substance is inorganic.	-	ECHA
Dissociation Constant (pKa)	Not applicable, substance is insoluble	-	ECHA
Water Solubility	With a loading of 10 g/L diiron trioxide to water at pH8 the dissolved iron was determined to be < 1 µg/L.	1	ECHA
Viscosity	Not applicable, substance is a solid	-	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for iron oxide.

NICNAS has assessed iron oxide in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to the environment.[1]

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

Iron is relatively immobile under most environmental conditions, mainly due to the very low solubility of iron (III) hydroxide in its various forms (ECHA). As an inorganic substance, iron oxide is expected to disassociate in the environment to its respective cation and anion as limited by its aqueous solubility and pH.

In soil, as well as in sediment-water systems, iron oxide will react and release iron ions and hydroxyl ions. Therefore, relevant information on adsorption/desorption of iron oxide can be broadened to

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=d85d433e-f36b-1410-8924-008e64e216c7

data on adsorption/desorption of iron and magnesium. The behaviour of hydroxyl ions depends on the pH buffer capacity of the tested medium. The pH buffer capacity is controlled by a whole range of processes (mineral dissolution/precipitation, protonation/deprotonation of pH dependent charge sites, reaction with CO_2, biological processes, etc.) and as such, partition coefficients are not relevant for the fate and behaviour of OH- in soils or sediment.

For iron an essential, homeostatically controlled element, the bioaccumulation potential is low. A similarly low potential is assumed for the poorly soluble iron oxide (ECHA).

As based on the physico-chemical properties and its extremely low water solubility, the substances of the "Iron Oxides Category" (iron oxides) are expected to have a low potential for adsorption, and studies on adsorption / desorption do not need to be conducted. All category members are ubiquitous in the environment. Iron, manganese and zinc are essential elements for humans, animals, plants and microorganisms. The Henry's law constant (HLC) and the distribution of iron oxides in the environment are not calculated according to the Mackay fugacity model, because the substances are inorganic and have an extremely low vapour pressure at ambient temperature. Iron oxides are not volatile from aqueous suspensions. In the atmosphere, iron oxide substances will exist solely in the particulate phase and may be removed from the air by wet and dry deposition.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Iron oxide is of low toxicity concern to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on iron oxide.

Table 3 Acute Aquatic Toxicity Studies on Iron Oxide

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Brachydanio rerio	96-hour LC_{50}	>/= 50000 mg/L	1	ECHA
Daphnia magna	48-hour EC_{50}	>/= 100 mg/L	2	ECHA

Chronic Studies

In accordance with section 1 of REACH Annex XI (ECHA), the study on long-term toxicity to fish does not need to be conducted. Natural baseline iron concentrations in the aquatic environment are much higher than the reported saturation concentrations of iron oxides in the environment. As such, it is unlikely that iron ions released from iron oxides would inhibit growth and proliferation of aquatic plants, animals or microorganisms.

Based on a study with diiron trioxide in nanoform, diiron trioxide is not chronically toxic to aquatic invertebrates. No effects of iron oxide nanoparticles on the reproduction of Daphnia magna were observed in a 21 -day chronic toxicity study according to OECD 211 up to the highest test concentration of 20 mg Fe_2O_3/L (ECHA) [KI.score =2].

A 72-hour algae growth inhibition test was conducted according to OECD 201 with iron oxide nanoparticles. No significant effect on the growth rate of *Pseudokirchneriella subcapitata* was observed at the applied concentrations of 8.2 to 20.0 mg/L and thus an unbounded 72 h NOEC ≥ 20 mg/L (nominal) was derived (ECHA) [KI.score=2].

C. Terrestrial Toxicity

No data are available on the effects of iron oxides on terrestrial organisms. Iron is ubiquitous in the environment. It comprises approximately 5% of the earth's crust andiron oxides are widespread in soils. Iron occurs mostly in the form of its oxides. The predominant iron mineral in soils is goethite (alpha-FeOOH). The most important iron ores are magnetite (Fe_3O_4) and hematite (alpha-Fe_2O_3).

The interstitial water of the soil is in contact with natural iron oxide minerals. Its concentrations of iron-, manganese- and zinc ions depend on several environmental factors (e.g. duration of contact, temperature and presence of humic substances) and natural complexions (e.g. siderophores). Input of iron oxide pigments will not increase the "saturation" concentrations. It is unlikely that synthetic pigments have any significant effect on ion contents in soil-water or on other soil properties. On the other hand, if the iron oxides would increase the soil content of iron-, manganese- and zinc ions, this would be a fertilizing effect, in line with the purpose of sewage sludge application on agricultural land.

Performing a test is scientifically not necessary, as the category members are inert inorganic oxides of iron which resemble naturally occurring iron oxides. Even under worst case conditions, an inhibitory effect of synthetic iron oxide pigments is not likely to be exerted on soil organisms.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bio accumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Iron oxide is an inorganic salt that dissociates to iron and hydroxyl ions in aqueous solutions. Biodegradation is not applicable to these inorganic ions; both iron and hydroxyl ions are also ubiquitous and are present in most water, soil and sediment. For the purposes of this PBT assessment, the persistent criteria are not considered applicable to this inorganic salt.

For iron an essential, homeostatically controlled element, the bioaccumulation potential is low. Thus, iron oxide does not meet the screening criteria for bioaccumulation.

There are no chronic toxicity data for this substance. Acute aquatic toxicity data are >1 mg/L. Thus, iron oxide does not meet the screening criteria for toxicity.

The overall conclusion is that iron oxide is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for iron oxide.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Iron oxide	1309-37-1	Not a PBT	No	No	NA	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

European Chemicals Agency [ECHA]. ECHA REACH database. https://echa.europa.eu/information-on-chemicals/registered-substances

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
HLC	Henry's law constant
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg/m^3	kilograms per cubic metre
kPa	kilopascal
LC	lethal concentration
mg/L	milligrams per litre
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases

MAGNESIUM CHLORIDE
MAGNESIUM CHLORIDE HEXAHYDRATE

This dossier on magnesium chloride and magnesium chloride hexahydrate presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Magnesium chloride and magnesium chloride hexahydrate are classified as **tier 1** chemicals and require a hazard assessment only.

1 BACKGROUND

Magnesium chloride and magnesium chloride hexahydrate dissociate completely in water to the Mg^{2+} cation and the chloride anion (Cl^-). Biodegradation is not applicable to magnesium chloride and magnesium chloride hexahydrate. Magnesium chloride, magnesium chloride hexahydrate and their dissociated ions are ubiquitous in the environment; they are not expected to adsorb to soil or sediment or to bioaccumulate. Magnesium chloride and magnesium chloride hexahydrate are of low toxicity concern to aquatic and terrestrial life.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Magnesium (2+) dichloride

CAS RN: 7786-30-3

Molecular formula: Cl_2Mg

Molecular weight: 95.2 g/mol

Synonyms: magnesium chloride; magnesium (2+) dichloride; magnesium chloride, anhydrous

Chemical Name (IUPAC): magnesium;dichloride;hexahydrate

CAS RN: 7791-18-6

Molecular formula: $Cl_2Mg.6H_2O$

Molecular weight: 203.30 g/mol

Synonyms: magnesium chloride hexahydrate; magnesium dichloride hexahydrate

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for magnesium chloride are shown in Table 1. Limited data was available for magnesium chloride hexahydrate.

Table 1 Overview of the Physico-chemical Properties of Magnesium Chloride

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Colourless or white hexagonal crystals	2	ECHA
Melting point	712°C @ 101.3 kPa	2	ECHA
Boiling point	Not applicable, melting point > 300 °C	-	ECHA
Density	2316 kg/m^3 @ 20°C	1	ECHA
Vapor Pressure	Not applicable, melting point > 300 °C	-	ECHA
Partition Coefficient (K_{ow})	Not applicable, substance is inorganic	-	ECHA
Dissociation Constant (pKa)	Not an ionisable organic substance	-	ECHA
Water Solubility	468.7 g/L @ 20°C	1	ECHA
Viscosity	Not applicable, substance is a solid	-	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for magnesium chloride or magnesium chloride hexahydrate.

NICNAS has assessed magnesium chloride and magnesium chloride hexahydrate in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to the environment provided that ANZECC[1] water quality guidelines for physical and chemical stressors are not exceeded[2][3].

NICNAS has assessed magnesium chloride hexahydrate in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to human health.[4]

In addition, based on an assessment of human health and environmental hazards, NICNAS also identified magnesium chloride as a chemical of low concern to the environment (NICNAS, 2017 and DoEE, 2017). Chemicals of low concern are unlikely to have adverse environmental effects or be a concern to human health if they are released to the environment from coal seam gas operations.

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[1] Water quality guidelines were revised in 2018 and are now referred to as Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG)

[2] https://www.industrialchemicals.gov.au/chemical-information/search-assessments?assessmentcasnumber=7786-30-3

[3] https://services.industrialchemicals.gov.au/assessment-detail/?id=7465433e-f36b-1410-8de4-00e8f2afc108

[4] https://services.industrialchemicals.gov.au/assessment-detail/?id=fb7f433e-f36b-1410-8c14-0026b2c59b62

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

Given its high solubility in water, magnesium chloride and magnesium chloride hexahydrate will dissociate and release magnesium (Mg^{2+}) and chloride (Cl^-) ions. The dissociated Mg^{2+} cation can then transform and form complexes with dissolved ligands present in natural waters. Magnesium is widespread in living cells and does not bioconcentrate in aquatic organisms. Environmental fate analysis based on log octanol water partition coefficient (K_{ow}) and log soil organic carbon partition coefficient (K_{oc}) and typical fugacity modelling is not applicable to these inorganic substances. Photodegradation and biodegradation are also not applicable to inorganic metal salts such as magnesium chloride (OECD, 2011).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Magnesium chloride and magnesium chloride hexahydrate are of low toxicity concern to aquatic and terrestrial life.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on magnesium chloride. No studies were available for magnesium chloride hexahydrate.

Table 3 Acute Aquatic Toxicity Studies on Magnesium Chloride

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Pimephales promelas	96-hr LC_{50}	2,119	2	ECHA
Daphnia magna	48-hr LC_{50}	548.4	2	ECHA
Daphnia magna	48-hr LC_{50}	1,328	2	ECHA
Ceriodaphnia dubia	48-hr LC_{50}	841.4	2	ECHA
Desmodesmus subspicatus	72-hr EC_{50}	>100	1	ECHA

Chronic Studies

The 21-day EC_{10} of magnesium chloride in a Daphnia magna reproduction test is 321 mg/L (ECHA) [Kl. score = 2]

C. Terrestrial Toxicity

No studies are available.

Magnesium and chloride ions are ubiquitous in the environment and are found naturally in soil, water and sediment (Mg in soils/sediments are at a 50th percentile level in the range of 0.9-1.2 %). Magnesium will be assimilated by species residing in the soil and is necessary to maintain a good chemical balance in soils, water and sediment. The chloride will become part of the chloride cycle and/or be assimilated by microorganisms and other species that require chloride as an essential substance in their biological systems/ processes. Natural magnesium minerals are soluble, and so differences in bioavailability between natural magnesium sources and anthropogenic added magnesium are not expected. For these reasons, magnesium chloride is not expected to be toxic to soil organisms. Therefore, short-term and long-term toxicity tests to terrestrial organisms are scientifically unjustified (ECHA).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Magnesium chloride and magnesium chloride hexahydrate are inorganic salts that dissociate completely to magnesium and chloride ions in aqueous solutions. Biodegradation is not applicable to these inorganic ions. For the purposes of this PBT assessment, the persistent criteria are not considered applicable to this inorganic salt.

Magnesium chloride and magnesium chloride hexahydrate are not expected to bioaccumulate; they will dissociate to ions that are ubiquitous in the environment. Thus, the substances do not meet the screening criteria for bioaccumulation.

The EC_{10} value from a chronic Daphnia reproduction study is >0.1mg/L. The acute EC_{50} values in aquatic toxicity studies are >1 mg/L. Thus, magnesium chloride and magnesium chloride hexahydrate do not meet the screening criteria for toxicity.

The overall conclusion is that magnesium chloride and magnesium chloride hexahydrate are not PBT substances.

B. Other Characteristics of Concern

No other characteristics of concern were identified for magnesium chloride and magnesium chloride hexahydrate.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Magnesium chloride	7786-30-3	Not a PBT	No	No	NA	No	No	No	1	1	1
Magnesium chloride hexahydrate	7791-18-6	Not a PBT	No	No	NA	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/cm^3	grams per cubic centimetre
g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard

IMAP	Inventory Multitiered Assessment and Prioritisation
IUPAC	International Union of Pure and Applied Chemistry
kPa	kilopascal
LC	lethal concentration
mg/L	milligrams per litre
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NOEC	no observed effect concentration
OECD	Organisation for Economic Co-operation and Development
PBT	Persistent Bioaccumulative Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases

MAGNESIUM SILICATE HYDRATE (TALC)
SEPIOLITE

This dossier on magnesium silicate hydrate (talc) and sepiolite presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam and shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed magnesium silicate hydrate (talc) and sepiolite in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessments and concluded that they pose no unreasonable risk to human health nor the environment[1234].

In addition, based on an assessment of human health and environmental hazards, NICNAS also identified magnesium silicate hydrate (talc) as a chemical of low concern to the environment (NICNAS, 2017 and DoEE, 2017). Chemicals of low concern are unlikely to have adverse environmental effects or be a concern to human health if they are released to the environment from coal seam gas operations.

Limited information is available for sepiolite. For the purpose of this dossier, talc is considered representative of sepiolite, which is a similar hydrated magnesium silicate.

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): dioxosilane; oxomagnesium; hydrate

CAS RN: 14807-96-6

Molecular formula: $H_2Mg_3O_{12}Si_4$

Molecular weight: 379.27 g/mol

Synonyms: Talcum, oxosilanediol, trimagnesium; dioxido(oxo)silane; hydroxy-oxido-oxosilane, dioxosilane; oxomagnesium; hydrate

SMILES: O=[Si](O)O[Mg]O[Si](=O)O[Mg]O[Si](=O)O[Mg]O[Si](=O)O

Chemical Name (IUPAC): tetramagnesium;tris(oxido-[oxido(oxo)silyl]oxy-oxosilane);dihydroxide;hexahydrate

CAS RN: 63800-37-3

Molecular formula: $Mg_4Si_6O_{15}(OH)_2 \cdot 6H_2O$

Molecular weight: 647.83 g/mol

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=f752433e-f36b-1410-8de4-00e8f2afc108
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=5249443e-f36b-1410-8e4e-00f1fcf8411a
[3] https://services.industrialchemicals.gov.au/assessment-detail/?id=aa8e433e-f36b-1410-8c14-0026b2c59b62
[4] https://services.industrialchemicals.gov.au/assessment-detail/?id=0b3c433e-f36b-1410-8924-008e64e216c7

Synonyms: sepiolite; meerschaum; sepiolite ($Mg_4(OH)_2(Si_2O_5)_3.6H_2O$)

SMILES: [Mg].[OH-].O=[Si]([O-])O[Si](=O)[O-].O

II. PHYSICO-CHEMICAL PROPERTIES

Magnesium silicate hydrate (talc) is a clay mineral, composed of hydrated magnesium silicate. Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of Magnesium Silicate Hydrate (Talc)

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	White solid odorless powder	2	ECHA
Melting Point	1,500°C @ 101.3 kPa	2	ECHA
Boiling Point	This substance is a solid that melts above 300°C	-	-
Density	2700 kg/m^3 @ 20°C	2	ECHA
Vapour Pressure	0 Pa at 25°C	2	ECHA
Partition Coefficient (log K_{ow})	-9.4 @ 25°C	2	ECHA
Water Solubility	0.0001 g/L @ 25°C; insoluble in water	2	ECHA
Flash Point	The study does not need to be conducted because the substance is inorganic.	-	-
Auto flammability	Preliminary results exclude self-heating of the substance up to 400 °C	-	ECHA
Viscosity	Not applicable as substance is a solid.	2	ECHA
Henry's Law Constant	0 Pa m^3/mol@ 25°C	2	ECHA

ND – not determined

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Magnesium silicate hydrate (talc) is an inorganic substance for which biodegradation is irrelevant. Moreover, it will not bioaccumulate and has a low potential to adsorb to soil.

B. Biodegradation

As an inorganic substance, magnesium silicate hydrate (talc) will not biodegrade. Soil and sediment degradation studies are not considered to be applicable as the test material is essentially insoluble in water and consists of materials which occur naturally in these compartments (ECHA).

C. Environmental Distribution

Magnesium silicate hydrate (talc) is insoluble in water. The log K_{OC} of was estimated to be 1.5027 which is equal to a K_{OC} value of 31.82 L/kg using the KOCWIN v2.00 QSAR method (ECHA). Based on this K_{oc} value, if released to soil, magnesium silicate hydrate (talc) is expected to have a low potential for adsorption. If released into water, the substance has a low potential for adsorption to sediment or suspended solids.

D. Bioaccumulation

There is no potential for bioaccumulation. Due to its inherent chemical-physical properties, such as absence of lipophilicity as well as the capability of the organism to excrete absorbed SiO_2 components, bioaccumulation can be disregarded. Magnesium is widespread in living cells and does not bioconcentrate in aquatic organisms (ECHA).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Talc is a mineral composed of hydrated magnesium silicate. Talc is essentially non-toxic by the oral and dermal routes. Talc is non-irritating to the eyes and skin. There was no toxicity or carcinogenic effects in rats. Talc is not genotoxic. No developmental toxicity was reported in pregnant female rats, mice or rabbits given oral doses of talc.

B. Basic Toxicokinetics

Inhalation

To determine the deposition, distribution and clearance of talc, 44 female Syrian golden hamsters received a single 2-hour nose-only exposure to a neutron-activated talc aerosol and sub-groups of 4 animals were then killed at 11 different intervals from 15 minutes to 132 days after exposure.

The talc tested was a commercial baby powder. Nine unexposed control animals were used; four were killed on the day the test animals were exposed and five were killed on the final day of the study. The aerosol exposure system had 7 tiers of exposure ports, and the talc aerosol was passed through a cyclone elutriator to remove particles that were larger than ~10 µm in diameter; the activity median aerodynamic diameter was 6.4-6.9 µm. The mean aerosol concentration was 40 and 75 µg/L at the 15 to 30 and 60 to 90-minute sampling periods, respectively. In the presentation of the results, the γ-ray counts from the controls were expressed as µg talc equivalent, and the γ-ray counts of the exposed animals were not corrected for control values.

Variations among animals killed at the same time were attributed to variations in aerosol concentration at different tiers. The mean pulmonary talc content in the lungs of test animals at various time intervals was 33.08 µg (15 minutes after exposure), 24.08 µg (100 minutes), 42.70 µg (4 hours), 18.75 µg (21 hours), 21.30 µg (2 days), 21.03 µg (after 4 days), 13.85 µg (after 8 days) and 8.95 µg (after 18 days); the mean for the Day 0 control animals was 1.78 µg. The biological half-life of the talc deposited in the lungs was 7 to 10 days. At the time of termination of the final group, i.e., 132 days, there was no statistically significant difference in the talc burden of the lungs of test (3.70 µg) and control (2.30 µg) animals. The amount of talc in the liver, kidneys and lungs was also determined; the only statistically significant differences compared to controls in any of these organs were found in the liver. There was a decrease at 4 hours compared to day 0 controls, an increase at Day 36 compared to both Day 0 and Day 132 controls, and an increase on Day 68 compared to Day 132 controls.

Analysis of the data using the Kruskal-Wallis test showed that there were no significant differences among the mean talc burden values for the liver, kidneys and ovaries, including the control values, and that there was no significant trend, indicating there was no translocation of talc to these tissues.

As noted, no translocation from the respiratory tract to other tissues was found in this study, and the clearance of talc from the lungs was complete within 4 months after exposure.

Oral

In one study, six female Syrian golden hamsters (outbred Ela:ENG strain) were dosed by gavage with 1 mL neutron-activated talc suspended in physiological saline containing 0.6% (w/w) 1% methyl cellulose, and the animals were killed 24 hours after dosing. The talc used was a commercial baby powder.

Four hamsters were dosed similarly with a non-irradiated talc solution. The neutron-activated talc was exposed to an integrated neutron flux of 7 x 1,016 n/cm^2 30 days prior to dosing. The skinned carcass, gastrointestinal (GI) tract, lungs, liver, kidneys and excreta were analysed for isotopes 60 Co and 46 Sc by gamma-ray spectrometry, and the gamma-ray counts were compared with those of four hamsters that were not dosed with talc.

The γ-ray counts of the tissue and excreta of the dose animals were equivalent to a total of 2.94 mg talc. Based on γ-ray counts, 74.5% of the neutron-activated talc was recovered in the faeces and 23.5% was recovered in the GI tract, while 1.91% was recovered in the skinned carcass, 0.09% in the urine, 0.04% in the kidneys and 0.02% in the liver. The amount found in the urine of the hamsters given irradiated talc was statistically significantly increased compared to the controls. No talc was recovered in the lungs (ECHA) [Kl score = 2].

In a second oral study, four LACA female mice were given a single oral dose of 40 mg/kg [3H] talc. Two mice were killed at 6 hours and two at 24 hours after dosing. In the mice killed 6 hours after dosing, 95 and 96% of the radioactivity was recovered in the large intestines and faeces, 9 and 7% was recovered in the small intestines and stomach, and 0.7 and 0% in the urine of each mouse. In the two mice killed 24 hours after dosing, 99 and 101% of the radioactivity was recovered in the large intestines and faeces, 4 and 6% was recovered in the small intestines and stomach, and 1.3 and 1.5% in the urine of each mouse. Less than 0.005% of the radioactivity was found in the carcass of any of the mice (ECHA) [Kl score = 2].

In a third oral study, three male Wistar albino rats were given a single oral dose and three rats were given six daily oral doses by gavage of 50 mg/kg body wt [3H] talc. After the last dose, urine and faeces were collected every 24 hours for 4 days and on Day 10; the rats were then killed. Within 24 hours after administration of the single dose, approximately 75% of the radioactivity was recovered in the faeces and only 1% was recovered in the urine. After 96 hours, a total of 95.8% of the dose was excreted in the faeces and 1.7% in the urine, with a total excretion of 97.5% of the dose. No radioactivity was recovered in the liver or kidneys 10 days after a single dose of talc. On Day 10 in the rats given six daily doses of [3H] talc, there was no radioactivity found in the faeces or livers, and there was a trace of radioactivity (< 0.02%) in the kidneys of these rats (ECHA) [Kl score = 2].

C. Acute Toxicity

Oral

A single oral dose of 5,000 mg/kg of talc prepared as an 18.3% (w/v) suspension in saline was administered to 10 male rats. All animals survived, and there were no signs of toxicity. In conclusion, the median lethal dose of Talc (Mg3H2(SiO3)4) after a single oral administration to male rats, observed over a period of 14 days is: LD50 > 5,000 mg/kg body weight (ECHA) [Kl Score = 2].

Inhalation

Groups of 5 male and female Wistar rats were treated with magnesium hydroxide as aerosol during 4 hours. No mortality or other relevant adverse effects were observed. An inhalatory LC_{50} (4-hour) value for magnesium hydroxide exceeding 2.1 mg/L was determined, being the maximum feasible concentration that could be tested (ECHA) [KI Score = 2].

Dermal

An OECD Guideline 402 (Acute Dermal Toxicity) was performed. Five males and five female Wistar rats were dermally exposed to a single talc dose of 2,000 mg/kg.

Approximately 24 hours before the test, the fur was removed from the dorsal area of the trunk using an electric clipper. Care was taken to avoid abrading the skin, and only animals with healthy intact skin were used. No less than 10% of the body surface was cleared for the application.

The test item was applied at a single dose, uniformly over an area which was approximately 10% of the total body surface. The test item was held in contact with the skin throughout a 24-hour period. At the end of the exposure period the residual test item was not removed.

Under the conditions of this study, single dermal application of the test item magnesium chloride hexahydrate to rats at a dose of 2,000 mg/kg body weight was associated with no mortality. The dermal LD_{50} was determined to be > 2,000 mg magnesium chloride hexahydrate/kg body weight (ECHA) [KI Score = 2].

Dermal

No studies were available.

D. Irritation

Skin

An *in vitro* skin irritation test was carried out with the reconstituted three-dimensional human skin model EPISKIN-SM™ (Skinethic). This skin model consists of normal (non-cancerous), adult human-derived epidermal keratinocytes (NHEK) which have been cultured to form a multilayered, highly differentiated model of the human epidermis. The NHEK are cultured on chemically modified, collagen-coated cell culture inserts. A highly differentiated and stratified epidermis model is obtained after a 13-day culture period and is comprised of the main basal, supra basal, spinous and granular layers and a functional stratum corneum.

The test item showed no irritant effects. The mean relative tissue viability (% negative control) was ≥ 50% (112.9%) after 15-minute treatment and 42-hour post incubation. The controls confirmed the validity of the study. The mean OD550 of the three negative control tissues was ≥ 0.6. The mean relative tissue viability (% negative control) of the positive control was ≤ 30% (22.6%). The standard deviation of replicate tissues of all dose groups was ≤ 30% (1.4% - 9.4%). It can be concluded that talc is non-irritating to skin (ECHA) [KI Score = 2].

Eye

An OECD Guideline 405 (Acute Eye Irritation / Corrosion) study was performed using magnesium chloride hexahydrate as a surrogate substance for talc. A dose of 0.1 g of the test item was applied

at a single dose in the conjunctival sac of one eye of each test animal after pulling the lower lid away from the eyeball. The lids were then gently held together for about 1 second in order to prevent loss of the material. The untreated contralateral eye served as control. Observations of the eye were made at 1, 24, 48 and 72 hours and 4 to 6 days.

Under the conditions of the study, single ocular instillation of the test item magnesium chloride hexahydrate to rabbits at a dose of 0.1 g produced irritant effects, which were fully reversible. Neither mortalities nor significant clinical signs of toxicity were observed. The test item is deemed to be non-irritating to eyes (ECHA) [KI Score = 2].

E. Sensitisation

No experimental data are available on the Talc ($Mg_3H_2(SiO_3)_4$) powder and silicates; however, there is long experience in humans. Data collected from industrial hygiene surveillance over the last 50 years do not indicate any potential for skin sensitisation. Despite the widespread cosmetic use of talc and special studies in volunteers (BIBRA, 1991) there are no indications of any allergenic effect (ECHA) [KI score = 3].

F. Repeated Dose Toxicity

Oral

A study equivalent or similar to OECD Guideline 452 (Chronic Toxicity Studies) was performed using male and female Wistar rats. Wistar rats (16 male and 16 female) were exposed to talc in feed which resulted in an amount taken up of 100 mg/kg/day. After feeding had been carried out for 101 days, the animals were observed until death and subsequently examined histopathologically.

One of the animals treated with talc showed a leiomyosarcoma of the stomach. Sarcomas, which were not associated with the talc treatment, were found in the uterus of two animals. No chronic pathological effect was associated with oral administration of talc over 5 months. No adverse effects were seen on general toxicity endpoints. Under the condition of this study, for a period of 101 days for male and female rats, the NOAEL of talc in a feeding study was 100 mg/kg/day (ECHA) [KI score = 2].

Inhalation

A study equivalent or similar to OECD Guideline 452 (Chronic Toxicity Studies) was performed using male and female Wistar rats. The Wistar rats (12 male and 12 female) were exposed whole body to aerosolised talc at a mean respirable dust concentration of 10.8 mg/m^3 for 7.5 hours per day, 5 days a week for 6 or 12 months.

Ten days after the end of each exposure period, 6 rats per group were killed; 12 rats per group died and 2 rats per group were unaccounted for. The remaining 4 rats per group were killed one year after the end of the exposure period. Minimal fibrosis was observed. Talc exposure led to distinct fibrosis that was comparable with that after exposure to chrysotile in the parallel group. A lung adenoma was detected in 1 of 24 animals treated with talc. In rats exposed by inhalation to 10.8 mg/m^3 Italian talc (grade 00000; ready milled; mean particle size, 25 µm) for 3 months, minimal fibrosis was observed, the degree of which did not change during the observation period after exposure. Animals that were exposed for 1 year had minimal to slight fibrosis, the degree of which had increased to moderate within 1 year after cessation of exposure.

A no observed adverse effect concentration (NOAEC) of 10.8 mg/m^3 was determined (ECHA) [KI Score = 2].

Dermal

No adequate studies for human health risk assessment are available.

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on talc are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on Talc

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Mammalian cell gene mutation (rat pleural mesothelial cells (RPMC)).	-*	ND	2	ECHA

*+, positive; -, negative
ND – not determined

Talc did not cause a statistically significant increase in sister chromatid exchanges (SCEs) and was not clastogenic. The test substance is non-mutagenic under the given experimental conditions (ECHA) [KI Score = 2].

In Vivo Studies

A study equivalent or similar to OECD Guideline 478 (Genetic Toxicology: Rodent Dominant Lethal Test) was performed per a rat dominant lethal assay on Sprague Dawley rats. Groups of 10 male rats were dosed by gavage with a single dose or once daily for 5 days with 30, 300, 3,000 or 5,000 mg/kg talc.

There were no dose-response or time trend patterns; talc did not induce dominant lethal mutations in this assay. Therefore, talc was not genotoxic in a rat dominant lethal assay (ECHA) [KI Score = 2].

H. Carcinogenicity

Oral

An OECD Guideline 453 (Combined Chronic Toxicity / Carcinogenicity Studies) was performed. In a feeding study of 16 male and 16 female Wistar rats, talc was added to the diet; this resulted in a dosage rate of 100 mg/kg/day. After feeding had been carried out for 101 days, the animals were observed until death (approximately 614 days) and subsequently examined histopathologically. One of the animals treated with talc showed a leiomyosarcoma of the stomach. Sarcomas, which were not associated with the talc treatment, were found in the uterus of two animals.

However, no differences in tumour incidence were noted between treated animals and 8 male and 8 female control animals fed basal diet throughout (average survival, 641 days).

Inhalation

In a lifetime experiment, three groups of 50 male and 50 female Syrian golden hamsters, 4 weeks of age, were exposed (whole body) by inhalation to an aerosol of talc baby powder that was prepared from Vermont talc by flotation (95% w/w platy talc with trace quantities of magnesite, dolomite, chlorite and rutile) for 3, 30 or 150 minutes per day, 5 days a week for 30 days. The mean aerosol concentration was 37.1 mg/m^3, with a measurable respiratory fraction of 9.8 mg/m^3 and a MMAD of 4.9 µm. A placebo exposed group comprised 25 males and 25 females. Two further groups of hamsters, 7 weeks of age, were exposed to talc aerosol for 30 or 150 minutes per day for 300 days. The mean aerosol concentration was 27.4 mg/m^3, with a measurable respiratory fraction of 8.1 mg/m^3 and a MMAD of 6.0 µm. Another placebo-exposed group comprised 25 males and 25 females. The survivors of the last two talc-exposed groups were killed at the age of 20 months.

No clinical signs of toxicity to talc were observed. The type, incidence and severity of lesions indicated no trend toward a dose-response and no statistically significant differences between exposed and control groups. The incidence of focal alveolar cell hyperplasia (25% in treated groups; 10% in controls) appeared to be affected by treatment, but a two-way weighted analysis showed no significant association. Thus, exposure of hamsters to talc via inhalation did not produce carcinogenic effects (ECHA) [KI Score = 2].

I. Reproductive Toxicity

An OECD Guideline 416 (Two-Generation Reproduction Toxicity Study) was performed. Groups of 12-15 gravid Dutch-belted female rabbits were dosed orally with 9, 42, 195 or 900 mg/kg bw talc in corn oil on Days 6-18 of gestation. Eight gravid negative controls were given only vehicle and nine gravid positive controls were dosed with 2.5 mg/kg bw of 6-aminonicotinamide on Day 9 of gestation. The dams were killed on Day 29 of gestation. A total of 1/8, 4/15, 2/12, 5/15 and 2/13 dams of the negative control, 9, 42, 195 and 900 mg/kg bw dose groups, respectively, died or aborted before Day 29 of gestation, and the number of live litters for these groups was 6/7, 10/11, 8/10, 10/10 and 7/11, respectively. Details on Results (PO): Administration of up to 900 mg/kg bw talc on Days 6-18 of gestation had no discernible effect on nidation or on maternal survival.

The number of abnormalities did not differ between test and control animals.

Details on Results (F1): Administration of up to 900 mg/kg bw talc on days 6-18 of gestation had no discernible effect on nidation or on foetal survival. The number of abnormalities did not differ between test and control animals.

The NOAEL was considered to be 900 mg/kg bw/day for reproduction toxicity study. A NOAEL of > 900 mg/kg/day was determined for reproduction (ECHA) [KI Score = 2].

J. Developmental Toxicity

A GLP compliant study was performed. Groups of 20-22 gravid albino CD-1 mice and groups of 20-24 gravid Wistar rats were dosed by gavage with 0, 16, 74, 350 or 1,600 mg/kg bw talc as an anhydrous corn oil suspension on days 6-15 of gestation. The mice were killed on Day 17 and the rats on Day 20 of gestation and the number of implantation sites, resorptions sites, and live and dead foetuses, and the live pup body weights were recorded.

Maternal Toxicity: The administration of up to 1,600 mg/kg bw talc in corn oil had no effect on maternal endpoints.

Embryotoxic / Teratogenic Effects: The administration of up to 1,600 mg/kg bw talc in corn oil had no effect on developmental parameters and had no effect on foetal survival.

The NOAEL was considered to be 1,600 mg/kg bw/day for developmental toxicity (ECHA) [KI score = 2].

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for talc follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2021).

A. Non-Cancer

Oral

The NOAEL of 100 mg/kg/day from a chronic feeding study in rats was used to determine the oral RfD and drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

- UF_A (interspecies variability) = 10
- UF_H (intraspecies variability) = 10
- UF_L (LOAEL to NOAEL) = 1
- UF_{Sub} (subchronic to chronic) = 1
- UF_D (database uncertainty) = 1
- Oral RfD = 100/(10 x 10 x 1 x 1 x 1) = 100/100 = 1 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

- Human weight = 70 kg (ADWG, 2021)
- Proportion of water consumed = 10% (ADWG, 2021)
- Volume of water consumed = 2L (ADWG, 2021)
- Drinking water guidance value = (1 x 70 x 0.1)/2 = 3.5 mg/L

B. Cancer

The carcinogenicity studies suggest talc is not a carcinogen. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Talc does not exhibit the following physico-chemical properties:

- Flammability
- Explosivity
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Talc is of low toxicity concern to aquatic organisms.

B. Aquatic Toxicity

Table 3 lists the results of the acute aquatic toxicity studies on magnesium silicate hydrate (talc).

Table 3: Acute Aquatic Toxicity Studies on Talc

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Fish (species unnamed)	96-hour LC_{50}	89,581 mg/L (QSAR)	2	ECHA
Daphnid	48-hour LC_{50}	36,812 mg/L (QSAR)	2	ECHA
Algae (species unnamed)	96-hour LC_{50}	7,203 mg/L	1	ECHA

Chronic Studies

No data are available. Short term aquatic toxicity tests reported in the literature on fish (LC_{50} *Brachydanio rerio* (Zebra fish) >100,000 mg/L/24 hr; for talc) show this substance is not toxic to aquatic life. On this basis the need for long term aquatic testing is waived (ECHA).

C. Terrestrial Toxicity

No data are available.

D. Calculation of PNEC

PNEC calculations for talc follow the methodology discussed in DEWHA (2009).

PNEC water

Acute experimental results are available for three trophic levels. Acute $E(L)C_{50}$ values are available for fish (89,581 mg/L), *Daphnia* (36,812 mg/L), and algae (7,203 mg/L). By applying an assessment factor of 100 to the lowest $E(L)C_{50}$ value of 7,203 mg/L from the acute studies, the $PNEC_{water}$ for talc is 72 mg/L.

PNEC sediment

There are no toxicity data for sediment-dwelling organisms. Moreover, the low K_{ow} indicates that talc is not expected to partition to sediments. Therefore, a $PNEC_{sed}$ was not calculated.

PNEC soil

There are no toxicity data for terrestrial or soil organisms. Moreover, talc is biodegradable and due to its low K_{ow}, is not expected to partition to soil. Therefore, a $PNEC_{soil}$ was not calculated.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Magnesium silicate hydrate (talc) is an inorganic substance and thus, biodegradation is not relevant. For the purposes of this PBT assessment, the persistent criteria are not considered applicable for this substance.

No data are available on bioaccumulation. However, based on the low log K_{ow}, and the inherent chemical-physical properties of magnesium silicate hydrate (talc), bioaccumulation is not expected. Thus, magnesium silicate hydrate (talc) does not meet the screening criteria for bioaccumulation.

Chronic aquatic toxicity data is not available. The $E(L)C_{50}$ values from the acute aquatic toxicity studies on magnesium silicate hydrate (talc) are > 1 mg/L. Thus, magnesium silicate hydrate (talc) does not meet the criteria for toxicity.

Therefore, magnesium silicate hydrate (talc) is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

H332- Harmful if inhaled.

B. Labelling

Warning

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Eye Contact

Immediately flush open eyes with plenty of water for at least 15 minutes. Remove contacts, if present and easy to do. Get medical attention immediately, preferably a physician for an ophthalmologic examination.

Skin Contact

For minor skin contact, avoid spreading material on unaffected skin. Remove and isolate contaminated clothing. Wash the contaminated area of body with soap and fresh water. Get medical attention. Launder contaminated clothing before reuse.

Inhalation

Move person to fresh air. Administer oxygen if breathing is difficult. Do not use mouth-to-mouth method if victim inhaled the substance; give artificial respiration with the air of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Give artificial respiration if victim is not breathing. Get medical attention immediately.

Ingestion

Do not induce vomiting. Rinse out mouth then drink plenty of water. Get medical attention.

Notes to Physician

All treatments should be based on observed signs and symptoms of distress in the patient.

B. Fire Fighting Information

Extinguishing Media

Use water spray or fog, foam, dry chemical or carbon dioxide.

Specific Exposure Hazards

Magnesium oxide, silicon oxides.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus and chemical-protective clothing.

C. Accidental Release Measures

Personal Precautions

Isolate area. Keep unnecessary and unprotected personnel from entering the area. Use personal protective clothing. Ensure adequate ventilation. Wear respiratory protection if ventilation is inadequate. Avoid dust formation. Avoid breathing vapours, mist of gas. Avoid contact with skin, eyes and clothing. Eliminate all sources of ignition.

Environmental Precautions

No specific environmental precautions required.

Steps to be Taken if Material is Released or Spilled

Eliminate all sources of ignition. Pick up with suitable absorbent material and transfer to a container for chemical waste. For large amounts: dike spillage and pump off product into container for chemical waste. Dispose of contaminated material as prescribed.

D. Storage and Handling

General Handling

Keep away from heat, sparks and flame. Avoid contact with eyes, skin and clothing. Avoid breathing vapour. Wash thoroughly after handling. Keep container closed. Use with adequate ventilation.

Storage

Keep container tightly closed. Store away from heat and light. Store in cool place. Keep container tightly closed in a dry and well-ventilated place.

E. Exposure Controls/Personal Protection

Occupational Exposure Standards

The workplace exposure standards for talc in Australia is as follows: 8-hour time weighed average (TWA) exposure limit of 2.5 mg/m^3 (containing no asbestos fibres).

Engineering Controls

Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Personal Protection Equipment

Respiratory Protection: If workers are exposed to concentrations above the exposure limit, they must use appropriate, certified respirators. If there are no applicable exposure limit requirements or guidelines, use an approved respirator. Selection of air-purifying or positive pressure supplied-air will depend on the specific operation and the potential airborne concentration of the product. For emergency conditions, use an approved positive-pressure self-contained breathing apparatus. The following should be effective types of air-purifying respirators: organic vapour cartridge with a particulate pre-filter.

Hand Protection: Use gloves chemically resistant to this material. Consult the SDS for appropriate glove barrier materials.

Skin Protection: Use protective clothing chemically resistant to this material. Selection of specific items such as face shield, boots, apron or full body suit will depend on the task.

Eye Protection: Use chemical goggles.

Other Precautions: Wash hands, forearms and face thoroughly after handling chemical products, as well as before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Talc is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGEMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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OXAZOLIDINE

This dossier on oxazolidine presents the most critical studies pertinent to the risk assessment of oxazolidine in its use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Oxazolidine was not identified in chemical databases used by NICNAS as an indicator that the chemical is of concern and is not a PBT substance. Oxazolidine was assessed as a tier 2 chemical for acute toxicity and as a tier 1 for chronic toxicity. Therefore, this substance is classified overall as a **tier 2** chemical and requires a hazard assessment and qualitative assessment of risk.

1 BACKGROUND

Oxazolidine is an organic UVCB (Chemical Substances of Unknown or Variable Composition, Complex Reaction Products and Biological Materials) substance. This substance undergoes hydrolysis, and its reaction products are formaldehyde and 2-hydroxylpropylamine (HPA).

Oxazolidine is readily biodegradable. This substance is completely hydrolysed in the environment and as a result, has a low potential for bioaccumulation. Likewise, it is expected to adsorb very little to soil, suspended solids, or sediment.

The acute toxicity of oxazolidine is moderate for oral, dermal, and inhalation routes of exposure. Depending on the concentration of the solution (neat vs. diluted), oxazolidine is corrosive to the skin and eyes. It is also a skin sensitiser. Oxazolidine induces local effects in the stomach after repeated exposure via oral gavage. However, this effect is not considered relevant to humans. The reaction products of oxazolidine are genotoxic in *in vitro* studies but not *in vivo* studies. There are no carcinogenicity studies on oxazolidine. Assuming that the possible mutagenic and carcinogenic effects of oxazolidine are based on the hydrolysis product formaldehyde, no carcinogenic effects are expected at these threshold concentrations. There is no evidence for adverse effects of the substance on embryo and foetal development at dose levels inducing no local maternal toxicity.

Overall, oxazolidine is moderately toxic to aquatic life.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): 5-methyl-3-[(5-methyl-1,3-oxazolidin-3-yl) methyl]-1,3-oxazolidine

CAS NO.:66204-44-2

Molecular formula: $C_9H_{18}N_2O_2$

Molecular weight: 186.25 g/mol

Synonyms: Oxazolidine, 3,3'-methylenebis[5-methyl-;3,3'-Methylenebis(5-methyloxazolidine); 3,3'-METHYLENEBIS[5-METHYLOXAZOLIDINE];5-methyl-3-[(5-methyl-1,3-oxazolidin-3-yl)methyl]-1,3-oxazolidine

3 PHYSICO-CHEMICAL PROPERTIES

Oxazolidine is a reaction mixture that consists of several constituents (water, formaldehyde, and HPA). At room temperature, the substance is completely miscible with water. In aqueous solution, a dynamic equilibrium exists, whose composition depends on the concentration, pH value, and temperature. Thus, a precise experimental determination of the physical-chemical properties of the mixture or its constituents is difficult (ECHA). Key physical and chemical properties for the substance are shown in **Table 1**.

Table 1 Overview of the Physico-Chemical Properties of Oxazolidine

Property	Value	Klimisch Score	Reference
Physical state at 20 °C and 101.3 kPa	Clear, colourless to yellowish liquid with an amine odour	2	ECHA
Melting Point	-60.5 °C @ 101.3 kPa	1	ECHA
Boiling Point	192.2 °C @ 101.3 kPa	1	ECHA
Density	1.05 (relative density) @ 20 °C	1	ECHA
Vapor Pressure	1.4 Pa @ 25 °C	2	ECHA
Partition Coefficient (log K_{ow})	-0.043 (temperature not provided)	1	ECHA
Water Solubility	Completely miscible at room temperature	1	ECHA
Dissociation constant (pKa)	pKa determination not possible due to hydrolysis	1	ECHA
Viscosity	21 mPa s @ 20 °C	2	ECHA

kPa = kilopascal
°C = degrees Celsius
mPa = Megapascal
s = second
ECHA = European Chemicals Agency

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances (AICS; Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for oxazolidine.

Table 2 Existing International Controls

Convention, Protocol, or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No

Convention, Protocol, or Other International Control	Listed Yes or No?
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Oxazolidine is readily biodegradable. This substance is completely hydrolysed in the environment and as a result, has a low potential for bioaccumulation. Likewise, it is expected to adsorb very little to soil, suspended solids, or sediment.

B. Partitioning

Oxazolidine is water soluble, and it is not expected to be volatile from aqueous solutions. This substance is completely hydrolysed in the environment, and its reaction products are formaldehyde and HPA. The reaction rate of hydrolysis was determined at different pH values via measurement of the formaldehyde being released. At pH 4 and 7, the formaldehyde content reached a plateau after approximately 1-2 hours, while the reaction was slightly slower at pH 9, reaching the plateau after 3-4 hours (ECHA). [KI. Score = 1].

C. Biodegradation

As per OECD Test Guideline 301 B (Ready Biodegradability: CO2 Evolution Test), there was 66.1% degradation after 4 days and 89.8% degradation after 28 days (ECHA). [KI score =1]. These results indicate that oxazolidine is readily biodegradable. In short, this substance and its hydrolysis products are expected to be extensively removed in biological treatment plants, as well as in aquatic compartments.

If a chemical is found to be readily biodegradable, it is categorized as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

D. Environmental Distribution

Oxazolidine rapidly degrades in water, so this substance could not be used for analysis; therefore, the reaction product 5-methyl-oxazolidine was used as the analytical target compound. As per OECD Test Guideline 121, the upper limit organic carbon to water partition coefficient (K_{oc}) value was estimated to be ≤1 litres per kilogram (L/kg; ECHA). [KI score =1]

Based on this K_{oc} value, oxazolidine is not expected to adsorb to soil if released and has a high mobility. If oxazolidine is released to water, it is not expected to adsorb to suspended soils or sediment based on its K_{oc} value and rapid hydrolysis.

E. Bioaccumulation

There are no bioaccumulation studies on oxazolidine. Therefore, quantitative structure-activity relationship (QSAR) models were used to calculate values for the bioconcentration factor (BCF) in earthworms (0.96 L/kg) and fish (1.41 L/kg) (ECHA). [Kl. Score = 1]. Based on these values, low potential for bioaccumulation is expected. Furthermore, the constituents of the reaction product hydrolyse in aqueous media.

6 HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

The acute toxicity of oxazolidine is moderate for oral, dermal, and inhalation routes of exposure. Depending on the concentration of the solution (neat vs. diluted) oxazolidine is corrosive to the skin and eyes. It is also a skin sensitiser. Oxazolidine induces local effects in the stomach after repeated exposure via oral gavage. However, this effect is not considered relevant to humans. The reaction products of oxazolidine are genotoxic in *in vitro* studies but not *in vivo* studies. There are no carcinogenicity studies on oxazolidine. Assuming that the possible mutagenic and carcinogenic effects of oxazolidine are based on the hydrolysis product formaldehyde, no carcinogenic effects are expected at these threshold concentrations. There is no evidence for adverse effects of the substance on embryo and foetal development at dose levels inducing no local maternal toxicity.

B. Toxicokinetics

Oxazolidine undergoes hydrolysis, which results in formaldehyde and 5-methyloxazolidine as reaction products. Toxicokinetic data could not be obtained on the parent compound because it is a complex mixture. However, data on formaldehyde is available considering that this is the most toxicologically important constituent of the mixture.

In rats, the dermal absorption for formaldehyde is 30-40%. The inhalation absorption for formaldehyde is 90% in rats, 67% in Monkeys, and 76% in humans. The oral absorption for formaldehyde in rats and mice has limited validity. Formaldehyde is rapidly oxidized to formic acid then it enters the carbon-1-metabolic pathway. Formic acid can also be cleaved to CO_2 and exhaled, or it can be excreted in the form of sodium formate via urine (ECHA). [KI Score =1].

C. Acute Toxicity

Oral

As per OECD Test Guideline 423 (Acute Oral Toxicity-Acute Toxic Class Method) and EU Method B.1 tris (Acute Oral Toxicity-Acute Toxic Class Method), the LD_{50} in male and female rats was determined to be 630 milligrams per kilogram bodyweight (mg/kg bw) (ECHA). [KI.score =1].

Dermal

As per OECD Test Guideline 402 (Acute Dermal Toxicity) and EU Method B.3 (Acute Toxicity Dermal), the LD_{50} in female rats was determined to be ≥760 mg/kg bw and in male rats was determined to be 1,200 mg/kg bw (ECHA) [KI score=1]. Another study identified a LD_{50} of 1,400 mg/kg bw in male and female rats combined (ECHA) [KI score=1].

Inhalation

As per OECD Test Guideline 436 (Acute Inhalation Toxicity: Acute Toxic Class Method), the LC_{50} in male and female rats was determined to be > 1000 milligrams per cubic metre (mg/m^3;nominal) (ECHA). [KI score =1].

D. Irritation

Skin

As per OECD Test Guideline 404 (Acute Dermal Irritation/Corrosion) and EU Method B.4 (Acute Toxicity: Dermal Irritation/Corrosion), oxazolidine was applied undiluted to the skin of rabbits for four hours and it was found to be corrosive. Application of diluted oxazolidine at a concentration of 5% resulted in slight skin irritation, and no effects were detected at a concentration of 1% (ECHA). [KI score =1].

Eyes

A study comparable to OECD guideline 405 was conducted using Grotan® OX, which contains para-formaldehyde and 2-HPA. Application of the undiluted product to the eyes of rabbits for 24 hours (unwashed) or 4 seconds (then washed) produced severe ocular reactions that were found to be irreversible. In short, when the neat substance is applied to the eyes of rabbits it is corrosive. Application of 0.2% Grotan® OX to the eyes of rabbits was found to be non-irritating (ECHA). [KI score=2].

E. Sensitisation

In a guinea pig maximization test conducted according to OECD Test Guideline 406, oxazolidine was identified as an extreme sensitizer. There is also supporting evidence from patch tests conducted in humans that indicate that this substance induces the highest frequency of contact allergy (ECHA). [KI score =2].

F. Repeated Dose Toxicity

Oral

As per OECD Test Guideline 408 (Repeated Dose 90-Day Oral Toxicity Study in Rodents), 10 male and 10 female rats were given oxazolidine via oral gavage once daily (7 days per week) for 90 days. The rats were administered the following doses: 0, 20, 60, 180, and 120 mg/kg bw (concentration 0, 0.4, 1.2, 3.6, and 2.4% in corn oil). At dose levels ≥60 mg/kg bw (LOAEL) and a concentration of ≥12 mg/mL, oxazolidine induced local effects in the stomach after repeated exposure via gavage. However, this finding is not relevant to humans. There were no effects observed at a daily dose of 20 mg/kg bw; therefore, a NOAEL was determined to be 20 mg/kg bw/day (ECHA) [KI score =1]).

As per OECD Test Guideline 408 (Repeated Dose 90 Day Oral Toxicity Study in Rodents), 10 male and 10 female rats were given oxazolidine via oral gavage once daily for 92 days in males and 93 days in female rats. The rats were administered the following doses: 0,30,72,180 mg/kg bw (concentration 0, 0.3, 0.72, or 1.8% in water). A LOAEL of 180 mg/kg bw/day was established based on effects on body weight, clinical chemistry, organ weights, and haematological and histological effects in the

high dose group of male rats. A NOAEL of 72 mg/kg bw/day was established based on changes in body weight, clinical chemistry and organ weights. The authors noted that this study has some lack of data interpretation, and they noted that the results may have been influenced by an infection with mycoplasma pneumonia (ECHA) [KI score = 2].

Inhalation

There are no studies available.

Dermal

There are no studies available.

G. Genotoxicity

The test substance (hydrolysis products of oxazolidine) was not mutagenic in genotoxicity assays in the bone marrow of mice. This indicates that the substance is not genotoxic distant from the site of first contact. However, mutagenicity assays *in vitro* reveal the reactivity of the substance towards DNA, which corresponds to the reactivity of formaldehyde. Data on the hydrolysis product formaldehyde suggested more local than systemic mutagenic effects. Formaldehyde is genotoxic *in vitro,* and it induces local clastogenic effects *in vivo* (ECHA).

In Vitro Studies

Table 3 lists the *in vitro* genotoxicity studies on oxazolidine.

Table 3 In Vitro Genotoxicity Studies on Oxazolidine[1]

Test System	Results		Klimisch Score	Reference
	-S9	+S9		
Bacterial Reverse Mutation Assay (S.typhimurium TA 1535 TA 1537 TA98 TA 100 and E.coli WP2)	+	+	1	ECHA
Bacterial Reverse Mutation Assay (S.typhimurium TA 1535 TA 1537 T A98 TA 100 and TA 102)	-	-	2**	ECHA
Bacterial Reverse Mutation Assay (S.typhimurium TA 1535 TA 1537 TA 98 and TA 100))	-	-	2**	ECHA
Mammalian cell gene mutation (mouse lymphoma L5178Y cells)	+	+	1	ECHA
Mammalian cell gene mutation (mouse lymphoma L5178Y cells)	+	+	1	ECHA
Chromosomal aberrations (Chinese Hamster Lung)	+	+	1	ECHA

*+, positive; -, negative
** Ambiguous results, substance was not tested up to the cytotoxicity threshold
1 – Test substance was a mixture of para-formaldehyde and 2-HPA

In Vivo Studies

As per OECD Test Guideline 474 (Mammalian Erythrocyte Micronucleus Test) five male and five female mice were administered CONTRAM™ MBO (which contains para-formaldehyde and 2-HPA) via oral gavage for 24 hours at the following dose levels: 0, 30, 100, and 300 mg/kgbw (concentrations of 0,0.15, 0.5, and 1.5). The test substance was determined to be negative for genotoxicity given the fact that it did not induce a statistically significant increase in the number of micronuclei at a dose level up to 300 mg/kg bw. At the 300 mg/kg bw dose, slight to moderate reduced motility, slight ataxia, slight reduced muscle tone and slight dyspnoea was observed 15 minutes to 3 hours after administration of the test substance (ECHA). [Kl. Score = 2].

As per OECD Test Guideline 475 (Mammalian Bone Marrow Chromosome Aberration Test) five male and five female mice were administered Grotmar 71, which contains para-formaldehyde and 2-HPA, via oral gavage for two days at the following doses: 0, 92, 183, and 367 mg/kg bw (concentrations of :0.92, 1.83, and 3.67%). The test substance displayed no genotoxic effects at the conclusion of the study because it did not induce a statistically significant increase in chromosomal aberrations in the bone marrow of mice (ECHA).[KI score =2].

H. Carcinogenicity

There are no long-term carcinogenicity studies available on experimental animals for oxazolidine. However, this substance is assumed to hydrolyse rapidly within the body. There are probable carcinogenic effects related to the hydrolysis product formaldehyde. Formaldehyde has mutagenic activity *in vitro* but it does not induce systemic mutagenic *in vivo*. Formaldehyde does induce local mutagenic effects *in vivo*. Sufficient data are available on carcinogenicity of formaldehyde, as well as the mode of action. In experimental animals, formaldehyde induces tumours at the site of first contact, but it does not induce systemic carcinogenic effects. The results of epidemiological studies are conflicting. The local carcinogenic effects of formaldehyde are dependent on cytotoxicity and cell proliferation. At non-irritant concentrations tumour formation is not expected. Assuming that the possible mutagenic and carcinogenic effects of oxazolidine are based on the hydrolysis product formaldehyde, no carcinogenic effects are expected at these threshold concentrations (ECHA).

I. Reproductive and Developmental Toxicity

As per OECD Test Guideline 415 (One Generation Reproduction Toxicity Study before October 9, 2017), oxazolidine was administered at the following doses: 0, 5, 15, and 45 mg/kg bw/day once daily to 24 male and 24 female rats via oral gavage until day 20 postpartum. A general NOAEL for parental animals was determined to be 5 mg/kg bw/day based on histopathological effects in the forestomach of male rats administered 15 and 45 mg/kg of oxazolidine. A systemic NOAEL for parental animals was determined to be 15 mg/kg bw/day based on reduced body weights observed in the animals dosed with 45 mg/kg of oxazolidine. The NOAEL for reproduction/developmental toxicity was determined to be 15 mg/kg bw/day based on an increased incidence of post implantation and postnatal loss in the animals dosed with 45 mg/kg of oxazolidine. There were no effects noted in the F1 progeny during the weaning phase and at necropsy (ECHA). [KI score =1].

As per OECD Test Guideline 414 (Prenatal Developmental Toxicity Study), oxazolidine was administered via oral gavage to 24 pregnant rabbits at the following doses: 0,5, 45,90, and 135 mg/kg bw/day (concentration: 0, 0.25,2.25,4.5, and 6.75%) at gestation day 6-28. In the animals dosed with 135 mg/kg of oxazolidine, there was a decrease in body weight and increased mortality and abortions, which indicate maternal toxicity. At necropsy, local lesions were found in the stomach, and there was an increased incidence in dilation of the renal pelvis. There were no effects identified in the animals dosed with 90 mg/kg of oxazolidine, and the authors concluded that the effects identified in the stomach were due to the corn oil vehicle. Therefore, the authors determined that the NOAEL for maternal toxicity was 90 mg/kg bw/day (ECHA). [KI score =1].

There were no developmental effects detected at 90 mg/kg bw/day so the NOAEL for fetotoxicity was determined to be 90 mg/kg bw/day. At the high dose levels the number of early and late resorptions was increased, the number of foetuses decreased, and the post-implantation loss and mortality of foetuses during the 6-hour incubator stay increased. There was no increase in the incidence of retardations, variations, or malformations in any treatment group (ECHA). [KI score =1].

J. Derivation of Toxicological Reference and Drinking Water Guidance Values

The toxicological reference values developed for oxazolidine follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

Non-Cancer

In a 90-day oral toxicity study, a NOAEL of 20 mg/kg bw/day was established based on local effects in the stomach. In a one generation reproductive toxicity study in rats, a systemic NOAEL for parental animals was determined to be 15 mg/kg bw/day based on reduced body weights observed in the animals dosed via oral gavage with 45 mg/kg of oxazolidine. The NOAEL for reproduction/ developmental toxicity was determined to be 15 mg/kg bw/day based on an increased incidence of post-implantation and postnatal loss in the animals dosed via oral gavage with 45 mg/kg of oxazolidine. The NOAEL of 15 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:
UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1

Oral RfD = 15/(10 x 10 x 1 x 10 x 1) = 15/1000 = 0.015 mg/kg bw/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

where:
Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)

Drinking water guidance value = (0.015 x 70 x 0.1)/2 = 0.0525 mg/L

Cancer

There were no carcinogenicity studies conducted on oxazolidine. Thus, a cancer reference value was not derived.

K. Human Health Hazard Assessment of Physico-Chemical Properties

Oxazolidine does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

7 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Overall, oxazolidine is moderately toxic to aquatic life. The acute toxicity of oxazolidine is of low concern to fish and invertebrates and of moderate concern to algae. The chronic toxicity of oxazolidine is of moderate concern to invertebrates and algae. Based on hazard data, invertebrates are slightly more sensitive than algae in chronic toxicity studies.

B. Aquatic Toxicity

In aqueous media, oxazolidine is rapidly hydrolysed (DT_{50} < 1 hour). At a concentration of 0.0025% (equally to 25 mg/L) the hydrolysis equilibrium is nearly complete at the hydrolysis products formaldehyde and 2-HPA. Therefore, in the concentration range applied in ecotoxicity tests, the reaction product is completely or nearly completely hydrolysed, and thus, observed effects are caused by the hydrolysis products. The comparison of aquatic toxicity data for the substance and its hydrolysis products reveals clearly that the toxicity of the substance is exclusively determined by its formaldehyde content (ECHA).

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on oxazolidine.

Table 4 Acute Aquatic Toxicity Studies on Oxazolidine

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Danio rerio (Zebrafish)	96-hr LC_{50}	71	1	ECHA
Danio rerio (Zebrafish))	96-hr LC_{50}	57.7	1	ECHA
Daphnia magna	48-hr EC_{50}	29	2	ECHA
Desmadesmus subspicatus	72-hr EC_{50}	5.7 (growth rate) 2.6 (biomass)	2	ECHA

Chronic Studies

There are no chronic studies on fish available. However, the available data on acute toxicity indicate that fish is the trophic level with the lowest sensitivity (ECHA).

As per OECD Test Guideline 211 (Daphnia magna Reproduction Test), *Daphnia magna* were exposed to oxazolidine for 21 days at concentrations ranging from 0.512 to 20.0 mg/L. Oxazolidine was found to be harmful toward daphnids reproduction and resulting 21-day no observed effect concentration (NOEC) was determined to be 1.3 mg/L based on mortality (ECHA). [KI score =1].

As per OECD Test Guideline 201 (Alga, Growth Inhibition Test) and EU Method C.3 (Algal Inhibition test), *Desmadesmus subspicatus* were exposed to oxazolidine for 72 hours at the following concentrations: 1.0, 2.2, 4.84, 10.65, and 23.43 mg/L. Oxazolidine was found to be harmful towards algae at low concentrations. The resulting 72-hour NOEC was determined to be 2.2 mg/L (growth rate) (ECHA).[KI score =2].

C. Terrestrial Toxicity

There are no studies available.

Furthermore, a K_{OC} value of 1 L/kg had been estimated for oxazolidine on the basis of a measured value log K_{OW} value for 5-methyl-oxazolidine. This value indicates a weak adsorption potential of the compound to soil and sediments (ECHA).

D. Calculation of PNEC

The PNEC calculations for oxazolidine follow the methodology discussed by DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (57.7 mg/L), invertebrates (29 mg/L) and algae (5.7 mg/L). Results from chronic studies are available

for invertebrates (1.3 mg/L) and algae (2.2 mg/L). On the basis that the data consists of short-term studies for three trophic levels and long-term results studies for two trophic levels, an assessment factor of 50 has been applied to the lowest reported NOEC of 1.3 mg/L for invertebrates. The $PNEC_{water}$ is 0.026 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Moreover, the substance is not expected to substantially partition to sediments. Nonetheless, a $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 0.017 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= 0.819/1280 \times 1000 \times 0.026$
$= 0.017$ mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 kg/m^3[default]
$PNEC_{water}$ = 0.026 mg/L

$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 0.04)/1000 \times 2400]$
$= 8.19E\text{-}01\ m^3/m^3$

And:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 kg/m^3[default]

$Kp_{sed} = K_{oc} \times f_{oc}$
$= 1 \times 0.04$
$= 0.04$ L/kg

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for oxazolidine based on OECD Test Guideline 121 is ≤1 L/kg (ECHA) [KI score =1].
f_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are no toxicity data for terrestrial or soil organisms. Moreover, the substance is not expected to strongly adsorb to soil. Nonetheless, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 0.00035 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
$= (0.02/1500) \times 1000 \times 0.026$
$= 0.00035$ mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 kg/m^3 [default]

$Kp_{soil} = K_{oc} \times f_{oc}$
$= 1 \times 0.02$
$= 0.02\ m^3/m^3$

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for oxazolidine based on OECD Test Guideline is 1 L/kg (ECHA) [KI score =1].
f_{oc} = fraction of organic carbon in soil = 0.02 [default].

8 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Oxazolidine is readily biodegradable; thus, it does not meet the screening criteria for persistence.

Based on estimated BCF values of 1.41 L/kg for fish, oxazolidine does not meet the screening criteria for bioaccumulation.

The lowest chronic NOEC for oxazolidine is >0.1 mg/L. The acute $E(L)C_{50}$ values are >1 mg/L. Thus, oxazolidine does not meet the screening criteria for toxicity.

The overall conclusion is that oxazolidine is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for oxazolidine.

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9 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on Relevant Databases?	Identified as Polymer of Low Concern	P criteria Fulfilled?	Other P Concerns	B Criteria Fulfilled?	T Criteria Fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Oxazolidine	66204-44-2	Not a PBT	No	No	No	No	No	No	1 (fish, inv) 2 (algae)	1	2

1 - PBT Assessment based on PBT Framework.
2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).
3 - Tier 2 - Hazard Assessment and Qualitative Assessment Only. Develop toxicological profile and PNECs for water and soil and provide qualitative discussion of risk.
B = bioaccumulative
COC = constituent of concern
NA = not applicable
P = persistent
PBT = Persistent, Bioaccumulative and Toxic
T = toxic

10 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
ADWG	Australian Drinking Water Guidelines
AICS	Australian Inventory of Chemical Substances
BCF	Bioconcentration factor
bw	body weight
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
HHRA	enHealth Human Risk Assessment
HPA	2-hydroxylpropylamine
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
Kl	Klimisch scoring system
K_{oc}	organic carbon normalised distribution coefficient
K_{ow}	octanol-water partition coefficient
kPa	kilopascal
L	litre
L/kg	litres per kilogram
LOAEL	lowest observed adverse effect level
m^3	cubic metre
mg/kg	milligrams per kilogram
mg/kg bw/day	milligrams per kilogram body weight per day
mg/L	milligrams per litre
mg/m^3	milligrams per cubic metre
mL	millilitre
mPa s	millipascal second
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
OECD	Organization for Economic and Cooperation and Development

Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
QSAR	quantitative structure-activity relationship
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RfD	Reference Dose
SGG	Synthetic Greenhouse Gases
UVCB	Chemical Substances of Unknown or Variable Composition, Complex Reaction Products and Biological Materials

PARAFFIN BASED PETROLEUM OIL

This dossier on paraffin based petroleum oil presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. It does not represent an exhaustive or critical review of all available data. Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion: Paraffin based petroleum oil rapidly degrades and is expected to be have low aquatic toxicity. Therefore, it is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

In general, mineral oil and paraffin liquid are considered synonymous and can be characterized as containing primarily (>60%) paraffinic hydrocarbons with low volatility (>C12) and low melting points (<C30 and liquid at ambient temperatures) (USEPA, 2006).

Paraffin based petroleum oil is readily biodegradable. It has potential to bioaccumulate. It is expected to adsorb to soil or sediment. It is expected to be a low concern of toxicity to aquatic and terrestrial organisms because of its rapid degradation in the environment.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): mineral oil - includes paraffin oil

CAS RN: 8012-95-1

Molecular formula: Unspecified

Molecular weight: Unspecified

Synonyms: paraffin oil; Primol D;

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of Paraffin Based Petroleum Oil

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Clear liquid	1	ECHA
Melting Point	< -15 @ 101.3 kPa	1	ECHA
Boiling Point	260-450 °C @ 101.3 kPa	2	ECHA
Density	720-900 kg/m^3 @ 20°C	2	ECHA
Vapor Pressure	Negligible	2	ECHA
Partition Coefficient (log K_{ow})	>4 (QSAR)	2	ECHA
Water Solubility	Insoluble	2	ECHA
Dissociation constant (pKa)	Not relevant	-	ECHA
Viscosity	7.92 – 9.9 mPa s	1	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 1). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for paraffin based petroleum oil.

Table 1 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

Paraffin based petroleum oil is readily biodegradable. It has potential to bioaccumulate. It is expected to adsorb to soil or sediment.

A. Biodegradation

Biodegradation testing is difficult for paraffin based petroleum oil as it is a UVCB substance. Predicted data indicate that it is readily biodegradable (ECHA).

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

B. Environmental Distribution

Based on a log K_{oc} of >3 (K_{oc} of 1,000 L/kg), paraffin based petroleum oil is expected to have only slight mobility in soil and it is expected to adsorb to soil or sediment (ECHA).

C. Bioaccumulation

No experimental data is available. Based on predicted log K_{ow} values of >4 for the components, paraffin based petroleum oil has potential for bioaccumulation (ECHA). This is supported by estimated BCF values for paraffin based petroleum oil components ranging between <1 L/Kg to 723 L/Kg (ECHA).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Aquatic Toxicity

Paraffin based petroleum oil a complex mixture UVCB substance of variable composition. It is not soluble in water and is comprised mostly of components with water solubility below 0.01 mg/L and, therefore, it is not possible to assess the acute toxicity of the substance to aquatic organisms. Environmental modelling suggests that most of components emitted to the air will likely to degrade in the atmosphere with only small to nil amounts to be found in water, soil and sediment. Further, paraffin based petroleum oil is readily biodegradable and will not persist in the environment (ECHA).

B. Terrestrial Toxicity

No data are available. Paraffin based petroleum oil is readily biodegradable and will not persist in the environment. Direct or indirect exposure of the soil compartment is unlikely (ECHA).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Paraffin based petroleum oil is readily biodegradable. Thus, it does not meet the criteria for persistence.

No data are available on bioaccumulation. Based on an estimated log K_{ow} of >4 and estimated BCFs for paraffin based petroleum oil components ranging between <1 L/Kg to 723 L/Kg, paraffin based petroleum oil is expected to bioaccumulate. Thus, it does meet the screening criteria for bioaccumulation.

It is not possible to assess the acute aquatic toxicity of paraffin based petroleum oil to aquatic organisms. It is expected to be a low concern of toxicity to aquatic organisms because of its rapid degradation in the environment. Thus, it does not meet the screening criteria for toxicity.

The overall conclusion is that paraffin based petroleum oil is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for paraffin based petroleum oil.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Paraffin based petroleum oil	8012-95-1	Not a PBT	No	No	No	No	Yes	No	None	None	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy
ECHA	European Chemicals Agency
EU	European Union
IChEMS	Industrial Chemicals Environmental Management Standard
IMAP	Inventory Multitiered Assessment and Prioritisation
IUPAC	International Union of Pure and Applied Chemistry
NAMW	number average molecular weight
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

UVCB	Unknown or Variable Composition, Complex Reaction Products and Biological Materials

HYDROCARBONS, C14-C17, N-ALKANES, <2% AROMATICS
HYDROCARBONS, C10-C14, N-ALKANES, ISOALKANES, <2% AROMATICS

This dossier on hydrocarbons, C14-C17, n-alkanes, <2% aromatics and hydrocarbons, C10-C14, n-alkanes, isoalkanes, <2% aromatics (hereafter referred to as paraffins, petroleum, normal C5-C20) presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed paraffins, petroleum, normal C5-C20 in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to human health.[1]

Information provided in this dossier is based on group member hydrocarbons, C10-C12, n-alkanes, <2% aromatics (EC RN 926-527-4) and alkanes, C12-14-iso- (CAS RN 68551-19-9).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): Paraffins, petroleum, normal C5-20

CAS RN: 64771-72-8

Molecular formula: CH_3- $(CH_2)_8$-CH_3 to CH_3- $(CH_2)_{12}$-CH_3, substance is a UVCB

Molecular weight: Unspecified, substance is a UVCB

Synonyms: paraffins (petroleum), normal C5-C20; normal paraffins (petroleum)

SMILES: CCCCCCCCCC

II. PHYSICO-CHEMICAL PROPERTIES

Paraffins, petroleum, normal C5-C20 is characterised as a complex combination of normal paraffins obtained by a selective adsorption process using a solid adsorbent such as a molecular sieve. It consists of straight chain saturated hydrocarbons having carbon numbers predominantly in the range of C5 through C20 and boiling in the range of 35 deg C to 345 deg C.

Key physical and chemical properties for the read-across substance are shown in Table 1.

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=5646433e-f36b-1410-8924-008e64e216c7

Table 1: Overview of the Physico-chemical Properties of hydrocarbons, C10-C12, n-alkanes, <2% aromatics

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Clear and bright flowing liquid	2	ECHA
Melting Point	-26 °C @ 101.3 kPa	2	ECHA
Boiling Point	181.4 °C @ 101.3 kPa	2	ECHA
Density	742.3 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	44 Pa @ 20°C	2	ECHA
Partition Coefficient (log K_{ow})	>3.17 and <6.73@ 20°C (QSAR)	2	ECHA
Water Solubility	>0.000027 and <0.142 g/L @ 20°C (QSAR)	2	ECHA
Flash Point	69 °C	2	ECHA
Auto flammability	200 °C	2	ECHA
Viscosity	1228 mPa s @ 20°C	2	ECHA
Henry's Law Constant	>0 and <12.4 Pa m^3/mol@ 20°C (QSAR)	2	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Aliphatic hydrocarbons composed of branched (isoalkanes) and cyclic aliphatic hydrocarbons in the C10 to C16 range have reported to be readily biodegradable to not inherently biodegradable. Based on the available data, paraffins, petroleum, normal C5-C20, is considered readily biodegradable. Paraffins, petroleum, normal C5-C20, based on read-across, are insoluble in water and are expected to highly adsorb to sediment and soil. They are not expected to bioaccumulate.

B. Biodegradation

In an OECD 301F test, hydrocarbons, C9-C11, n-alkanes, isoalkanes, cyclics, <2% aromatics degraded 80% after 28 days, indicating ready biodegradation (ECHA) [Kl. score = 1].

In an OECD 301F test, hydrocarbons, C10-C13, isoalkanes, cyclics (<2% aromatics) degraded 89.8% after 28 days, indicating ready biodegradation (ECHA) [Kl. score = 2].

In an OECD 301F test, hydrocarbons, C12-C15, n-alkanes, isoalkanes < 2% aromatics degraded 71% after 28 days indicating ready biodegradation. (ECHA) [Kl. score = 1].

In an OECD 301F test, hydrocarbons C12-16, isoalkanes, cyclics (<2% aromatics) degraded 22% after 28 days and 50% after 70 days, indicating inherent biodegradation (ECHA) [Kl. score 2].

In a USEPA OTS 796.3100 aerobic aquatic biodegradation test, hydrocarbons, C13-C15, isoalkanes, cyclics (<2% aromatics) degraded 16.95% after 24 days and 20.62% after 31 days, indicating that it is not inherently but ultimately biodegradable (ECHA) [Kl. score = 2].

In a USEPA OTS 796.3100 aerobic aquatic biodegradation test, hydrocarbons, C12-C13, isoalkanes, cyclics (<2% aromatics) degraded 12.69% after 24 days and 13.69% after 31 days, indicating that it is not inherently but ultimately biodegradable (ECHA) [Kl. score = 2].

Overall, paraffins, petroleum, normal C5-C20 are expected to be readily biodegradable in the environment. If a chemical is found to be inherently or readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

Paraffins, petroleum, normal C5-C20 are UVCB substances. The standard tests to determine the soil organic carbon partition coefficient (K_{oc}) are for single substances and not for UVCB substances. Therefore, a K_{oc} value for Paraffins, petroleum, normal C5-C20 was not determined.

The calculated K_{oc} values for substances in this group ranges from 465.69 - 356205 L/kg, using SPARC v4.2 program in the CONCAWE Library of PETRORISK (ECHA). These values, along with the low solubility of substances in this group, suggest that paraffins, petroleum, normal C5-C20 will highly adsorb to sediment and soil.

D. Bioaccumulation

Paraffins, petroleum, normal C5-C20 are UVCB substances. The calculated BCF values for linear aliphatic compounds undecane (C11), dodecane (C12), and tetradecane (C14) are 337.8, 790.9, and 962.9 L/kg, respectively, using the BCFWIN V2.16 model within EPISuite 3.12. The predicted BCFs for hydrocarbons are considered to be generally overly conservative because biotransformation is not quantitatively taken into account. For these linear aliphatic hydrocarbons, based on BCFs for indicator compounds - the values indicate that they are not expected to bioaccumulate.

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Limited data are available for paraffins, petroleum, normal C5-C20; therefore, the human health assessment relies on read-across data for group member read-across aliphatic hydrocarbons. The acute toxicity of read-across group member, hydrocarbons, C10-C12, isoalkanes, <2% aromatics, is low by the oral, dermal and inhalation route. It was slightly irritating to the skin and non-irritating to the eye. It is not a skin sensitiser. Repeated dose toxicity studies showed no target organ effects; oral exposures to very high doses of these hydrocarbons showed irritation to the gastrointestinal tract and effects in the liver that likely represent an adaptive response to the metabolism of the hydrocarbons and not a toxic response. Group members are not genotoxic; nor do they exhibit any evidence of reproductive or developmental toxicity in rats.

B. Metabolism

If C9-C14 aliphatic, <2% aromatic hydrocarbon fluids are absorbed, they are typically metabolised by side chain oxidation to alcohol and carboxylic acid derivatives. These metabolites can be glucuronidated and excreted in the urine or further metabolised before being excreted. The majority of the metabolites are excreted in the urine and to a lower extent, in the feces. Excretion is rapid with the majority of the elimination occurring within the first 24 hours of exposure (ECHA).

C. Acute Toxicity

Oral

An acute oral toxicity study was conducted in accordance with OECD 401 guidelines, where male and female rats were exposed to 5000 mg/kg hydrocarbons, C10-C12, isoalkanes, <2% aromatics by oral gavage. The animals were observed for 14 days post-exposure for signs of toxicity. There were no deaths in this study and ano-genital staining, observed at the 6-hour interval, was the only remarkable clinical observation. All animals were free of abnormalities at postmortem examination. The acute oral LD50 was >5000 mg/kg (ECHA). [Kl. Score=1]

Inhalation

To assess acute inhalation toxicity (OECD 403), hydrocarbons, C10-C12, isoalkanes, <2% aromatics was administered via individual inhalation chambers to male and female Sprague-Dawley rats to an average actual vapor concentration of 6100 mg/m^3 for four hours. Animals were observed for fourteen days following exposure for signs of toxicity. There were no mortality or gross pathological alterations noted in any of the animals. Based on the conditions of this study, The LC50 for acute inhalation exposure to hydrocarbons, C10-C12, isoalkanes, <2% aromatics vapor is greater than 6100 mg/m^3 (ECHA). [Kl. Score=1]

Dermal

The acute dermal toxicity of hydrocarbons, C10-C12, isoalkanes, <2% aromatics was evaluated in rabbits following topical occlusive exposure. Test material was applied as a single dose of 3160 mg/kg to the clipped backs of 3 male and 3 female rabbits, covered with a gauze patch, and secured with non-irritating tape and a plastic sleeve. The test material remained in contact with the skin for 24 hours. Observations were made as to the nature, onset, severity, and duration of toxicological signs 2, 4, and 24 hours after dosing and once per day thereafter, for a total of 14 days. Dermal responses were evaluated 24 hours after topical application and on Days 3, 7, 10, and 14 according to the Draize method of scoring. Application of hydrocarbons, C10-C12, isoalkanes, <2% aromatics at a dose level of 3160 mg/kg showed no evidence of systemic toxicity under the conditions of this study and all animals survived to study termination. There were no deaths or treatment-related clinical signs. Topical exposure elicited very slight to well defined erythema in all animals and very slight oedema in four animals. Desquamation was noted in five animals during the study. By Day 14, all animals were clear of erythema and oedema. Based on the results of this study, the dermal LD50 for hydrocarbons, C10-C12, isoalkanes, <2% aromatics is greater than 3160 mg/kg (ECHA). [Kl. Score=1]

D. Irritation

Skin

In a dermal irritation study conducted in accordance with OECD 404 guidelines, undilute hydrocarbons, C9-C11, isoalkanes, cyclics, <2% aromatics was administered via semi-occlusive patch for four hours to male rabbits. Dermal responses were evaluated at 1, 24, 48, and 72h post-dosing and on Day 7 according to the Draize method of scoring. Dermal responses were observed in all animals. At the 45-minute, 48 hour and 72-hour observations, three animals displayed well-defined erythema and three displayed very slight erythema. Four animals were noted with well-defined erythema and two were noted with very slight erythema at the 24-hour observations. At study termination (Day 7), four animals showed very slight erythema No other dermal observations were

noted during the study. The mean erythema and oedema scores for hydrocarbons, C9-C11, isoalkanes, cyclics, <2% aromatics were 1.56 and 0 respectively (ECHA). [Kl. Score=1]

Eye

In an eye irritation study conducted in accordance with OECD 405 guidelines, undilute hydrocarbons, C9-C11, isoalkanes, cyclics, <2% aromatics was administered to the right eye of six male rabbits. Ocular examinations occurred at 1h, 24h, 48h, 72h, and day 7 post instillation. Ocular damage was assessed and scored according to the Draize eye test. All animals survived the exposure. Ocular instillation of the test material elicited conjunctival irritation limited to redness noted in five of the six test animals at the 1-hour observation. No other signs of ocular irritation were noted during the study. The mean corneal opacity, iris lesion, conjunctivae redness, and chemosis scores for hydrocarbons, C9-C11, isoalkanes, cyclics, <2% aromatics were 0, 0, 0, and 0 respectively (ECHA). [Kl. Score=1]

E. Sensitisation

In a skin sensitisation study conducted in accordance with OECD 406 guidelines, 20 guinea pigs were treated by intradermal injections of 1.0% (w/v) hydrocarbons, C10 – C12, isoalkanes, < 2% aromatics to induce sensitization and then further sensitised by dermal application of 50.0% (w/v) of the test material. Guinea Pigs were challenged by topical application of 25.0% (w/v) hydrocarbons, C10 – C12, isoalkanes, < 2% aromatics. All animals survived to termination of study. There was a very low incidence of clinical in-life observations noted throughout the test period. Following topical challenge with 25.0% (w/v) of the test material, all animals were free of dermal irritation. The substance is not considered a skin sensitiser (ECHA). [Kl. Score=2]

C9-C14 aliphatic, <2% aromatic hydrocarbon fluids were not skin sensitisers when tested in guinea pig maximisation tests (ECHA) [Kl. Score = 2].

A C9-C14 aliphatic, <2% aromatic hydrocarbon fluid showed no indication of skin sensitisation in a human repeated insult patch test (ECHA).

F. Repeated Dose Toxicity

Oral

In repeated-dose oral toxicity study conducted in accordance with OECD 422 guidelines, male and female Sprague Dawley rats (10 animals per sex per dose) were dosed with decane (CAS RN 124-18-5) daily by gavage at exposure levels of 0, 25, 150, or 1000 mg/kg/day. Males were dosed from the 14th day prior to mating, during mating until the end of the mating period. Females were dosed from the 14th day prior to the start of the mating phase to day 4 of lactation. Oral dosing of decane produced no evidence of any adverse effects on clinical observations, organ weights, gross pathology, neurobehavioral activity, clinical chemistry or hematology endpoints. Evidence of irritation of the nonglandular mucosa of the stomach was observed but was considered an artifact of the dosing method and not attributed to the inherent toxicity of the test material. Based on these data, the no-observable- adverse effect level (NOAEL) for repeated dose toxicity was >=1000 mg/kg/day, the highest dose tested (ECHA). [Kl. Score=1]

Male and female rats were dosed by oral gavage with 0, 500, 2,500 or 5,000 mg/kg with a C9- C14 aliphatic (<2% aromatic) hydrocarbon fluid 7 days/week for 13 weeks. Additional groups of animals were dosed with 0 or 5,000 mg/kg for 13 weeks, followed by a 4-week recovery period. There were

dose-related changes in the hematology and serum chemistry parameters which were consistent with changes seen in the liver. Hepatocellular hypertrophy (liver cell enlargement) was seen in both males and females in all dose groups and were reversible. The liver effects were not considered to be an indication of toxicity but an adaptive response due to the metabolism of the hydrocarbons. There were also mucosal thickening and other signs of irritation to the stomach and anus, which appeared to be the direct result of high-dose intubation of a locally irritating material. All treatment-related effects were reversible within the 4-week recovery period. The NOAEL for systemic effects in this study is considered to be 5,000 mg/kg-day (ECHA) [Kl. Score = 1].

Hydrocarbons C11-C14, n-alkanes, isoalkanes, cyclics (<2% aromatics) (CAS RN 64742-47-8). Tested in a 90-day repeated oral toxicity test (OECD TG 408) in Sprague Dawley rats. The study design included a 28-day recovery period for rats exposed to the highest dose (1000 mg/kg/day). The NOAEL was 1000 mg/kg/day (OECD 2012) [Kl. Score = 2].

Hydrocarbons C10-C12 isoalkanes (<2% aromatics) (CAS RN 64742-47-8). Tested in a 90-day repeated oral toxicity test (OECD TG 408) in Sprague-Dawley rats. The study design included a 28-day recovery period for rats exposed to the highest dose (1000 mg/kg/day). The NOAEL was 1000 mg/kg/day (OECD 2012) [Kl. Score = 2].

Inhalation

In a repeated-dose inhalation toxicity study conducted in accordance with OECD 413 guidelines, male and female rats were administered 2600, 5200 or 10400 mg/m^3 hydrocarbons, C10-C12, isoalkanes, <2% aromatics vapor (whole body). The animals were exposed for 6 hours/day, 5 days/week for 13 weeks. No mortality or treatment-related effects in any of the hematology and serum chemistry values were observed. Liver and kidney weights were increased in male rats at all exposure levels; male heart weights were increased at the highest exposure level; liver and kidney weights were increased in female rats at 10400 mg/m3. In addition, the male rats showed tubular degeneration and hyaline inclusion-droplets in the epithelium at all concentrations. There was also scattered degeneration of the proximal renal tubules which showed cytoplasmic pallor and shrinkage. Occasionally the degenerate tubules were surrounded by a lymphocyte infiltrate. Many tubules also showed dilatation of the cortico-medullary junction, the dilated tubule being filled with a flocculent eosinophilic material. The kidney effects observed in male rats are indicative of alpha-2u-globulin nephropathy. Alpha-2u-globulin nephropathy, also known as hyaline droplet nephropathy, results from the formation of complexes with a naturally occurring protein (alpha-2u-globulin) in the kidneys of male rats. These complexes can accumulate in the proximal renal tubule and may produce species-specific histopathological changes. These kidney effects are specific to male rats and are not considered to be of biological relevance to humans. Histopathological examination did not reveal any abnormalities that were considered treatment related. As there were no pathologic changes, changes in organ weights mentioned above were judged to have been compensatory rather than toxic effects. Based on these results, the No Observed Adverse Effect Concentration (NOAEC) was greater than or equal to 10400 mg/m^3 (ECHA). [Kl. Score=1]

Dermal

No data available

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on read-across substance hydrocarbons, C10-C12, isoalkanes, <2% aromatics are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on Hydrocarbons, C10-C12, isoalkanes, <2% aromatics

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial Reverse Mutation Assay (OECD 471)	-	-	1	ECHA
Mammalian Chromosome Aberration Test (OECD 473)	-	-	1	ECHA
Sister Chromatid Exchange Assay (OECD 479)	-	-	2	ECHA
Mammalian Cell Gene Mutation Test (OECD 476)	-	-	2	ECHA

*+, positive; -, negative

In Vivo Studies

In a dominant lethal assay (OECD 478), hydrocarbons, C10-C12, isoalkanes < 2% aromatics was administered by vapor inhalation for six hours/day for five consecutive days to male rats at dose levels of 300 and 900 ppm to test for mutagenic potential. Included in the study was a negative (chamber exposed) control group and a positive control group. The latter received 0.5mg/kg of triethylenemelamine administered intraperitoneally on a single day, two hours prior to mating. Each group contained 10 proven fertile rats. Overall, no treatment related effects were observed. Based on these data, hydrocarbons, C10-C12, isoalkanes < 2% aromatics when administered by vapor inhalation to male rats is not considered mutagenic by the dominant lethal test (ECHA). [Kl. Score=1]

In two separate studies involving two different C9-C14 aliphatic (<2% aromatic) hydrocarbon fluids, male and female CD-1 mice were given a single oral gavage dose at concentrations of 0, 1,250, 2,500, or 5,000 mg/kg. The frequency of micronucleated polychromatic erythrocytes was not significantly increased in the treated mice compared to that in the controls (ECHA) [Kl. Score = 1].

In two separate dominant lethal studies involving two different C9-C14 aliphatic (<2% aromatic) hydrocarbon fluids, male rats were exposed 6 hours/day for 5 consecutive days to exposure concentrations of 0, 300, or 900 ppm. There was no evidence of a mutagenic response in the treated rats (ECHA) [Kl. Score = 2].

H. Carcinogenicity

Oral

No data available. The available data and available weight of evidence demonstrate that read-across group member hydrocarbons, C10 -C12, n-alkanes, <2% aromatics are highly unlikely to be carcinogenic (ECHA).

Inhalation

No data available

Dermal

No data available

I. Reproductive Toxicity

In the repeat dose toxicity test (OECD 422), males and female rats were given 0, 100, 300 and 1000 mg/kg undecane. Male rats were dosed for 46 days (14 days prior to mating and then during the mating period) and female rat from 14 days before mating to day 3 of lactation. The NOAEL for repeat dose toxicity is >=1000 mg/kg/day for both sexes. The NOAEL for reproductive performance is >=1000 mg/kg/day (ECHA). [Kl. Score=1]

In a Reproduction / Developmental Toxicity Screening Test (OECD 422), groups of male and female Sprague Dawley rats were dosed with decane daily by gavage at exposure levels of 0, 25, 150, or 1000 mg/kg/day. Males were dosed from the 14th day prior to mating, during mating until the end of the mating period. Females were dosed from the 14th day prior to the start of the mating phase to day 4 of lactation. There were no treatment-related effects at any dose level on any of the reproductive parameters evaluated in this study. These included measures of reproductive performance (mating, conception, gestation length, litter size), offspring survival (gestation and postnatal survival indices, percent pre- and post-implantation loss), pup body weight and pup sex ratio. There were no treatment-related effects at any dose level on any of the developmental parameters evaluated in this study including external abnormalities of pups, number of live and still births, mortality, sex determination, and weights of pups. Based on these data, the no-observable-adverse-effect level (NOAEL) for developmental toxicity was 1000 mg/kg/day and the NOAEL for reproductive toxicity was 1000 mg/kg/day (ECHA). [Kl. Score=1]

J. Developmental Toxicity

Oral

No additional developmental toxicity studies were identified.

Inhalation

In a Prenatal Development Toxicity Study (OECD 414), hydrocarbons, C9-C11, isoalkanes, cyclics, <2% aromatics was administered to pregnant female rats by inhalation exposure to vapor concentrations of 300 or 900 ppm, 6 hours/day during gestation days 6 to 15. Also, a negative control (chamber exposed) group and a positive control group that was treated via gastric intubation on gestational days 6-15 with 400mg/kg/day of acetylsalicylic acid. All surviving females were sacrificed on Day 21 of testation and foetuses examined for external, soft tissue and skeletal malformations. Pregnancy rate, mortality, body weight gain and gross postmortem observations were unaffected by treatment. Material treatment at either dose level had no effect on reproductive endpoints, foetal size, sex distribution, ossification variation, or foetal examination endpoints. Thus, there was no evidence of maternal or foetal toxicity at either exposure level of hydrocarbons, C9-C11, isoalkanes, cyclics, <2% aromatics tested. Based on these results, both the maternal and developmental NOAELs were greater than or equal to 900 ppm (5220 mg/m^3) (ECHA). [Kl. Score=2]

Dermal

No data available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for paraffins, petroleum, normal C5-C20 follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

A 13-week oral gavage study was conducted on a C9-C14 aliphatic (<2% aromatic) hydrocarbon fluid in rats. There were no adverse effects at 5,000 mg/kg-day, the highest dose tested. Alternatively, two other subchronic 90-day tests indicate that the NOAEL for this substance is 1,000 mg/kg/day. A NOAEL for decane in a repeat dose combined reproduction/developmental toxicity study also determined a value of 1,000 mg/kg/day. Therefore, the NOAEL of 1000 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

- UF_A (interspecies variability) = 10
- UF_H (intraspecies variability) = 10
- UF_L (LOAEL to NOAEL) = 1
- UF_{Sub} (subchronic to chronic) = 10
- UF_D (database uncertainty) = 1
- Oral RfD = 1000/(10 x 10 x 1 x 10 x 1) = 1000/1000 = 1.0 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

- Human weight = 70 kg (ADWG, 2011)
- Proportion of water consumed = 10% (ADWG, 2011)
- Volume of water consumed = 2L (ADWG, 2011)
- Drinking water guidance value = (1.0 x 70 x 0.1)/2 = 3.5 mg/L

B. Cancer

The available data and available weight of evidence demonstrate that read-across group members are highly unlikely to be carcinogenic. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Paraffins, petroleum, normal C5-20 do not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Based on read-across to similar group members, paraffins, petroleum, normal C5-20 is expected to have low acute and chronic toxicity to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on read-across group members for paraffins, petroleum, normal C5-20.

Table 3: Acute Aquatic Toxicity Studies on Paraffins, Petroleum, Normal C5-20

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Danio rerio (Zebrafish)	96-hr LL_{50}	>100 (C11-C13 n-alkanes with <2% aromatics)	1	ECHA
Cyprinus carpio (Carp fish)	96-hr LL_{50}	>100 (C12-C15 n-alkanes with <2% aromatics)	1	ECHA
Oncorhynchus mykiss (Rainbow trout fish)	96-hr LL_{50}	>1,000 (C9-C10, C9-C11 C10-C13, C11-C14 n-alkanes with <2% aromatics)	1	ECHA
		>792,000 (C10-C13 n-alkanes with <2% aromatics)	2	
		>803,000 (C11-C14 n-alkanes with <2% aromatics)	2	
		>87,556 (C12-C16 n-alkanes with <2% aromatics)	2	

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Daphnia magna (Water flea)	48-hr EL_{50}	>100 (C12-C15 n-alkanes isoalkanes with <2% aromatics)	1	ECHA
Daphnia magna (Water flea)	48-hr EL_{50}	>1000 (C11-C14 n-alkanes isoalkanes cyclics with <2% aromatics)	1	ECHA
Daphnia magna (Water flea)	48-hr EL_{50}	>1000 (n-decane, n-undecane, n-dodecane, n-tridecane, n-tetradecane)	2	ECHA
Raphidocelis subcapitata (Green alga)	72-hr EL_{50}	>100 (growth, tridecane and undecane, C12-C15 n-alkanes containing isoalkanes with <2% aromatics)	1	ECHA

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on read-across group members for paraffins, petroleum, normal C5-20.

Table 4: Chronic Aquatic Toxicity Studies on Paraffins, Petroleum, Normal C5-20

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Daphnia magna (Water flea)	21-day NOELR	>10.2 (C11-C13 n-alkanes)	1	ECHA
Daphnia magna (Water flea)	21-day NOELR	1 (C11-C13 containing isoalkanes with less than 2% aromatics)	1	ECHA
Raphidocelis subcapitata (Green alga)	72-hr NOELR	≥100 (growth, tridecane and undecane, C12-C15 n-alkanes containing isoalkanes with <2% aromatics)	1	ECHA

C. Terrestrial Toxicity

Paraffins, petroleum, normal C5-20 and read-across group members are complex petroleum UVCBs whose constituents have variable physicochemical properties. Therefore, a modelling framework is needed to account for the bioavailability of the constituents in the mixture, which was then used to predict the toxicity of the substance as a whole. The target lipid model (TLM) and HC5, have been applied to soils and sediment using equilibrium partitioning (EqP) model. The model used for the calculations was the PETROTOX v4.0 model. PETROTOX is a well-documented and peer reviewed model that is widely used across the chemicals industry (ECHA).

The toxicity of this substance to soil macroorganisms, terrestrial arthropods, terrestrial plants and soil microorganisms has been predicted using the target lipid model (TLM) and HC5, and using the equilibrium partitioning (EqP) model (ECHA). [Kl. Score = 2]

The predicted 14-d LL50 (mortality) of this substance to *Eisenia fetida* is 1983.63 mg/kg soil dw and the predicted 56-d EL10 (reproduction) is 380.01 mg/kg soil dw.

The predicted 28-d LL50 (mortality) of this substance to *Folsomia candida* is 1115.48 mg/kg soil dw and the predicted 28-d EL10 (reproduction) is 213.69 mg/kg soil dw.

The predicted 14-d EL50 (seedling emergence) of this substance to *Avena sativa* is 5098.70 mg/kg soil dw and the predicted 21-d EL10 (growth) is 976.76 mg/kg soil dw. The predicted 14-d EL50 (seedling emergence) of this substance to *Brassica rapa* is 3292.00 mg/kg soil dw and the predicted 21-d EL10 (growth) is 630.65 mg/kg soil dw.

The predicted 24-h EL50 (nitrite utilization) of this substance to Nitrobacter is 30935.69 mg/kg soil dw and the predicted 24-h EL10 (nitrite utilization) is 5926.38 mg/kg soil dw.

D. Calculation of PNEC

The PNEC calculations for paraffins, petroleum, normal C5-20 follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (>100 mg/L), invertebrates (>100 mg/L), and algae (>100 mg/L). NOEC values from long-term studies are available for invertebrates (1 mg/L) and algae (≥100 mg/L). On the basis that the data consists of short-term results from three trophic levels and long-term results from two trophic levels, an assessment factor of 100 has been applied to the lowest reported NOELR of 1 mg/L for invertebrates. The $PNEC_{water}$ is 0.01 mg/L.

PNEC Sediment

Using the QSAR model PETRORISK, v7.04 the estimated $PNEC_{sediment}$ value for read-across group member C11-15-iso- is 260 mg/kg soil wet weight (CONCAWE) [Kl. score = 2].

PNEC Soil

Using the QSAR model PETRORISK v7.04, the estimated $PNEC_{sediment}$ value for read-across group member C11-15-iso- is 100 mg/kg soil wet weight (CONCAWE) [Kl. score = 2].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Based on read-across, paraffins, petroleum, normal C5-20 is readily biodegradable and thus does not meet the screening criteria for persistence.

Paraffins, petroleum, normal C5-C20 are UVCB substances. Calculated BCF values for read-across linear aliphatic compounds range between 338 L/Kg and 963 L/Kg. The predicted BCFs for hydrocarbons are considered to be generally overly conservative because biotransformation is not quantitatively taken into account. Thus, paraffins, petroleum, normal C5-20 do not meet the screening criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on read-across substances for paraffins, petroleum, normal C5-20 are > 0.1 mg/L. The acute E(L)C_{50} values are > 1 mg/L. Thus, paraffins, petroleum, normal C5-20 does not meet the criteria for toxicity.

The overall conclusion is that paraffins, petroleum, normal C5-20 is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Asp. Tox 1

B. Labelling

Danger

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard for paraffins, petroleum, normal C5-20 has not been established in Australia.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Paraffins, petroleum, normal C5-20 is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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PENTASODIUM DIETHYLENETRIAMINE PENTAACETATE

This dossier on pentasodium diethylenetriamine pentaacetate presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed pentasodium diethylenetriamine pentaacetate in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to human health.[1]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): pentasodium N,N-bis{2-[bis(carboxylatomethyl)amino]ethyl}glycinate

CAS RN: 140-01-2

Molecular formula: $C_{14}H_{18}N_3Na_5O_{10}$

Molecular weight: 503.258 g/mol

Synonyms: glycine, n,n-{bis{2-bis{carboxymethyl)amino}ethyl}-, pentasodium salt; pentasodium diethylenetriamine pentaacetate; sodium diethylenetriaminepentaacetate,

SMILES: [Na+].[Na+].[Na+].[Na+].[Na+].[O-]C(=O)CN(CCN(CC([O-])=O)CC([O-])=O)CCN(CC([O-])=O)CC([O-])=O

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of pentasodium diethylenetriamine pentaacetate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Solid off-white powder. Odourless. or Colourless liquid. Odourless.	2	ECHA
Melting Point	-22°C @ 101.3 kPa when in liquid solution When in solid form the substance decomposes without melting.	2	ECHA
Boiling Point	105.6°C @ 101.3 kPa when in liquid solution	2	ECHA

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=5e46433e-f36b-1410-8924-008e64e216c7

Property	Value	Klimisch Score	Reference
	When in solid form the substance decomposes before boiling.		
Density	1300 kg/m^3@ 20°C in liquid form 1670 kg/m^3@ 20°C in solid form	2	ECHA
Vapour Pressure	0 Pa @ 25°C	2	ECHA
Partition Coefficient (log K_{ow})	-2 @ 25°C	2	ECHA
Water Solubility	65 g/L @ 20°C	2	ECHA
Flash Point	Not flash detected	2	ECHA
Auto flammability	386°C	2	ECHA
Viscosity	32.4 mPa s @ 25°C or 17.2 mPa s @ 45°C	2	ECHA
Henry's Law Constant	Not available	-	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Pentasodium diethylenetriamine pentaacetate is not readily biodegradable. However, it is not expected to bioaccumulate. It has low potential to adsorb to soil or sediment.

B. Biodegradation

Pentasodium diethylenetriamine pentaacetate is persistent. In several studies in water, no detectable biodegradation was observed. In an activated sludge study under aerobic conditions, there was <10% degradation after 28 days, as determined by oxygen consumption and carbon dioxide evolution (ECHA) [Kl. Score = 1].

If a chemical is found to be not readily biodegradable, it is categorised as Persistent since its half-life is substantially greater than 60 days (DoEE, 2017).

C. Environmental Distribution

No experimental data was available. Based on a predicted K_{oc} of 97.7 L/kg (USEPA, 2026), pentasodium diethylenetriamine pentaacetate is not expected to strongly adsorb to soil. If released to water, based on this K_{oc} value and its water solubility, it is expected to preferentially partition to the water column where it is hydrolytically stable in water but susceptible to photodegradation in water (ECHA).

D. Bioaccumulation

No experimental data was available. Based on a log K_{ow} of -2, pentasodium diethylenetriamine pentaacetate has a low potential for bioaccumulation (ECHA).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Pentasodium diethylenetriamine pentaacetate is considered a low hazard from acute/short term exposures. It is not irritating to the skin, eyes or respiratory tract and is not a skin sensitiser. Based on the data available, the chemical may have some adverse effects (decreased body weight, clinical chemistry) from repeated exposures to high concentrations. The substance is not genotoxic when tested in *in vitro* assays and is not considered mutagenic or carcinogenic based on studies on similar compounds to pentasodium diethylenetriamine pentaacetate. There is no indication that this compound has reproductive toxicity, but some development effects may be associated with high exposures based on animal studies.

B. Metabolism

For pentasodium diethylenetriamine pentaacetate, data on metabolism are not available, thus data described herein is based on studies of similar compounds, such as diethylenetriamine pentaacetate (DTPA, CAS RN 67-43-6) and ethylene diaminetetraacetic acid (EDTA). These compounds are poorly absorbed by both oral (3-5%) and dermal exposures (0.001%) routes of exposure but are more readily absorbed if inhaled as either an aerosolized particle or as airborne particulate matter (ECHA).

In one study, both intravenous and oral dosing of carbon labelled DTPA was administered to human volunteers to determine amount unchanged in urine and faeces. Upon oral exposure, the majority of DTPA was excreted in the feaces (between 95-100%) within 2-5 days. For systemically administered DTPA, the major route of excretion was unchanged in the urine, with an estimated half-life of 2 hours (Stevens et al. 1962). [Kl. Score = 2]

There are many studies where the effects of administering DTPA to animals and man on the excretion of essential metals such as calcium, zinc, iron, manganese, magnesium etc. have been studied. Systemic administration of DTPA (intravenous, intraperitoneal, subcutaneous) causes as increased urinary excretion of zinc, calcium and to a lesser extent iron and manganese. The reason for the increase in the urinary excretion of certain metals following systemic exposure to DTPA is due to its formation of complexes with ‘free’ metals in the blood and lymph. These complexes are then excreted via the urine, carrying the metals out of the body (ECHA).

DTPA has a high affinity for zinc and as such, zinc is one of the metals most affected by administration of the substance. The increased excretion of zinc following prolonged administration of DTPA to humans has manifested as a zinc deficiency, treatable with supplementation of zinc sulphate, or administration of the zinc complex of DTPA (ECHA).

C. Acute Toxicity

No acute toxicity studies are available for pentasodium diethylenetriamine pentaacetate. However, ECHA has identified structurally suitable compounds, DTPA (and salts) and EDTA (and salts), as suitable read across compounds for pentasodium diethylenetriamine pentaacetate.

Oral

An OECD Guideline 401 (Acute Oral Toxicity) test was conducted on DTPA. In this study, male and female HC/CFY rats were orally gavaged with a dose of 5000 milligrams per kilogram body weight (mg/kg-bw) of DTPA in water and observed for 14 days. Transient clinical effects (e.g., piloerection, posture, abnormal gait, lethargy, salivation, and diarrhea) were observed but resolved by the fifth

day. No mortality was recorded and autopsy findings were normal at the end of the observation period. Based on this read across study for DTPA, an oral LD50 of >5000 mg/kg-bw is identified for pentasodium diethylenetriamine pentaacetate (ECHA). [Kl. Score = 2]

Inhalation

Although no toxicity studies are available, pentasodium diethylenetriamine pentaacetate is classified as Acute Respiratory Hazard 4, Harmful if Inhaled (H332). This designation is based on the structural similarity to EDTA as a read across. In this study, mortality in 6 of 10 laboratory animals (unspecified) was observed after exposure to 1000 milligrams per cubic meter of air (mg/m^3). Although the size of the EDTA test particle (2 micrometers (mm)) is significantly smaller than the average particle of commercially available pentasodium diethylenetriamine pentaacetate (>100 mm) indicating less likelihood of significant airborne concentrations, it was concluded that under some conditions, pentasodium diethylenetriamine pentaacetate could pose a similar acute inhalation hazard (ECHA).

Dermal

An OECD Guideline 402 (Acute Dermal Toxicity) test was conducted on male and female Sprague-Dawley rats. Five animals per sex were exposed to 2000 mg/kg bw read-across pentapotassium DTPA for 24 hours and observed for 14 days. After 14 days, no mortality was observed with clinical effects limited to mild skin effects (encrustations) that resolved by day nine of the observation period. Therefore, the dermal LD50 for pentasodium diethylenetriamine pentaacetate is assumed to be >2000 mg/kg bw based on a read across of DTPA (ECHA). [Kl. Score = 2]

D. Irritation

Although some incidence of irritation has been reported to the sodium salt of DTPA, this irritancy potency has been attributed to residual hydroxide present in commercial mixtures. Pure pentasodium diethylenetriamine pentaacetate would not contain residual hydroxide and would not be expected to be irritating to the eyes or skin (ECHA).

Skin

An OECD Guideline 406 (Skin Sensitization)/Beuhler test was conducted on male and female Hartley guinea pigs for the surrogate compound, DTPA. Ten animals per sex were exposed to 0.25 grams (g) of DTPA for on days 1, 7 and 14 for 6 hours (hrs) each time. Clinical observations for dermal irritation were conducted at 24 and 48 hrs post exposure. No indication of localized irritation was observed during any observation period. Based on this study, DTPA, and by read across pentasodium diethylenetriamine pentaacetate, are not irritating to skin (ECHA). [Kl. Score = 1]

Eye

In an OECD Guideline 405 (Acute Eye Irritation/Corrosion) test, 0.1 mL of undiluted pentasodium diethylenetriamine pentaacetate was applied to three (sex unspecified) White New Zealand rabbits and clinicals findings recorded 1, 24, 48, 72 hrs and 8 days after exposure. Some slight irritation (conjunctival redness and swelling) was observed in 1-2 of the test subjects for up to 24 hrs but was resolved at the end of the observation period (8 days) and all eyes appeared normal (ECHA). [Kl. Score = 2]

For a structurally similar compound, pentapotassium DTPA, a similar OECD Guideline 405 test was conducted on three White New Zealand rabbits with a single exposure to 0.1 mL of undiluted DTPA

with observations at 24, 28 and 72 hrs and up to 7 days post exposure. After 72 hrs, no evidence of eye irritation was observed in the test subjects (ECHA). [Kl. Score = 2]

Based on these studies, pentasodium diethylenetriamine pentaacetate is not classified as an eye irritant (ECHA).

E. Sensitisation

No sensitisation studies are available for pentasodium diethylenetriamine pentaacetate, directly, however, a read across study for DTPA, is available. In an OECD Guideline 406 (Skin Sensitisation)/Beuhler test, five male and five female Hartley guinea pigs were exposed to DTPA on days 1, 7 and 14 for 6 hours each time. Clinical observations for evidence of skin sensitization (as irritation) were conducted at 24 and 48 hours post exposure. No localized skin sensitisation was observed during any observation period. Based on this study, DTPA, and by read across pentasodium diethylenetriamine pentaacetate, are not classified as skin sensitisers (ECHA). [Kl. Score = 1]

F. Repeated Dose Toxicity

Oral

An OECD guideline 407 study (Repeated Dose 28-Day Oral Toxicity Study in Rodents) was conducted for male and female Wistar rats exposed to Trilon C liquid (>43.7% pentasodium diethylenetriamine pentaacetate in water) in drinking water at 75, 420 and 1775 mg/kg-bw daily for 28 days. In the 420 and 1775 mg/kg-bw dose groups, decreases in body weight, increases in alanine aminotransferase (males) and decreases in alkaline phosphatase were observed. No substance-induced changes were detected in the 75 mg/kg-bw dose group. Based on this study, a NOAEL of 75 mg/kg-bw was identified for pentasodium diethylenetriamine pentaacetate (ECHA). [Kl. Score = 1]

Inhalation

There are no inhalation toxicity studies available for pentasodium diethylenetriamine pentaacetate, however, there are two studies for a structurally analogous compound, EDTA, that are available for read across evaluation.

In an OECD Guideline 412 (Subacute Inhalation Toxicity) test for Trilon BD (disodium salt of EDTA), male Wistar rats were exposed to an aerosol of EDTA at concentrations of 30, 300 and 1000 milligrams per cubic meter in air (mg/m^3) for 6 hrs a day for five consecutive days and observed for 14 days post exposure. In the high dose group, 6 of 20 rats died due to respiratory effects. In surviving rats, these effects were reversible after 14 days. In the low dose group, milder respiratory effects of the larynx and lungs were observed and were also reversible after 14 days (ECHA). [Kl. Score = 1]

In an OECD Guideline 413 (Subchronic Inhalation Toxicity: 90-Day Study) test, male and female Wistar rats were exposed to EDTA dust (as Trilon BD) at 0.5, 3, and 15 mg/m^3 for six hrs per day, five days per week for 13 weeks. At the end of the exposure period, males did not have any treatment related effects noted, included clinical toxicology and chemistry, histological examinations of larynx, liver and lungs. Female rats did exhibit some histological changes to the larynx. Based on this study, a NOAEC of 3 mg/m^3 is identified for pentasodium diethylenetriamine pentaacetate (ECHA). [Kl. Score = 1]

Dermal

No studies available.

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on pentasodium diethylenetriamine pentaacetate (with pentapotassium DTPA as a read-across compound) are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on pentasodium diethylenetriamine pentaacetate

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay) (*Salmonella typhimurium TA1537, TA1535, TA98, TA100*)	-	-	1	ECHA
OECD Guideline 473 equivalent (*In vitro* Mammalian Chromosome Aberration Test) (Chinese hamster ovary (CHO))	-	-	1	ECHA

*+, positive; -, negative

In Vivo Studies

No studies available.

H. Carcinogenicity

No carcinogenicity studies are available for pentasodium diethylenetriamine pentaacetate, however, a two-year study for carcinogenicity of EDTA did not find any evidence of carcinogenicity. Thus, pentasodium diethylenetriamine pentaacetate is not expected to be carcinogenic (ECHA).

I. Reproductive Toxicity

Due to the chelating properties of pentasodium diethylenetriamine pentaacetate and similar read-across substances DTPA and its salts, reproductive toxicity studies were not required. If dietary multi generation reproductive toxicity studies were to be performed with DTPA in the absence of any supplementation of essential minerals such as zinc, then it is highly likely that the chelating agents would complex with enough of the zinc in the diet leading to an insufficient zinc intake in the animals. This would lead to evidence of male reproductive toxicity (specifically degeneration of the testicular tissue and reduced fertility), developmental toxicity such as terata of the skeletal and viscera (see further) and many of the symptoms of zinc deficiency such as alopecia, diarrhea, eye and skin lesions etc. Such studies would therefore not provide evidence of the reproductive toxicity of the chelating agents but rather the toxicity associated with a deficiency in zinc (ECHA).

J. Developmental Toxicity

An OECD Guideline 414 (Prenatal Developmental Toxicity Study) for pentasodium diethylenetriamine pentaacetate (as Trilon C liquid) was conducted on female Wistar rats. Test subjects were orally gavaged with pentasodium diethylenetriamine pentaacetate at doses of 100, 400 and 1000 mg/kg-bw from day 6 to day 15 post coitum.

The 100 mg/kg-bw group did not have any statistically significant differences on dams, gestational parameters or fetuses. In the 400 and 1000 mg/kg-bw group, there was a statistically significant increase in the rate of skeletal retardations compared to the control group. Maternal toxicity was only observed in the 1000 mg/kg-bw group. Based on this study, a NOAEL of 100 mg/kg-bw is identified for development effects of pentasodium diethylenetriamine pentaacetate (ECHA). [Kl. Score = 1]

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for pentasodium diethylenetriamine pentaacetate follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

~~Oral~~

A subchronic study of pentasodium diethylenetriamine pentaacetate in drinking water in rats identified a NOAEL of 75 mg/kg-bw. The NOAEL from this study is based on decreases in body weight and clinical chemistry at higher doses (LOAEL = 420 mg/kg-bw). This NOAEL will be used to derive an oral reference dose and drinking water guideline value for pentasodium diethylenetriamine pentaacetate.

(*Oral Reference Dose (oral RfD)*

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 75/(10 x 10 x 1 x 10 x 1) = 75/1000 = 0.075 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.075 x 70 x 0.1)/2 = 0.26 mg/L

B. Cancer

No oral studies were available for the carcinogenicity of pentasodium diethylenetriamine pentaacetate. Thus, a cancer reference value for the substance was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Pentasodium diethylenetriamine pentaacetate does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Pentasodium diethylenetriamine pentaacetate is expected to have low acute and chronic toxicity to aquatic organisms. No studies are available for terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on pentasodium diethylenetriamine pentaacetate.

Table 3: Acute Aquatic Toxicity Studies on Pentasodium Diethylenetriamine Pentaacetate

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Oncorhynchus mykiss (Rainbow trout)	96-hr LC_{50}	>854	2	ECHA
Daphnia carinata (Water flea)	48-hr EC_{50}	310	2	ECHA

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on pentasodium diethylenetriamine pentaacetate.

Table 4: Chronic Aquatic Toxicity Studies on Pentasodium Diethylenetriamine Pentaacetate

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Melanotaenia fluviatilis (Crimson-spotted rainbowfish)	28-day NOEC	127	2	ECHA
Daphnia carinata (Water flea)	18-day NOEC	64	2	ECHA

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Scenedesmus quadricauda (Green algae)	23-day NOEC	400 (growth) (read-across EDTA)	2	ECHA

C. Terrestrial Toxicity

No studies available.

D. Calculation of PNEC

The PNEC calculations for pentasodium diethylenetriamine pentaacetate follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (>854 mg/L), invertebrates (310 mg/L), and algae (>400 mg/L). NOEC values from long-term studies are available for fish (127 mg/L), invertebrates (64 mg/L) and algae (400 mg/L). On the basis that the data consists of short-term and long-term results from three trophic levels, an assessment factor of 10 has been applied to the lowest reported NOEC value of 64 mg/L for invertebrates. The $PNEC_{water}$ is 6.4 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 13 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (2.67/1280) \times 1000 \times 6.4$
$= 13$ mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 3.908/1000 \times 2400]$
$= 2.67\ m^3/m^3$

Where:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
$= 97.7 \times 0.04$
$= 3.908$ L/kg

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The estimated K_{oc} for pentasodium diethylenetriamine pentaacetate is 97.7 L/kg.

F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are no toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 8.3 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$

$= (1.954/1500) \times 1000 \times 6.4$

$= 8.3$ mg/kg

Where:

Kp_{soil} = soil-water partition coefficient (m^3/m^3)

BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]

$Kp_{soil} = K_{oc} \times f_{oc}$

$= 97.7 \times 0.02$

$= 1.954$ m^3/m^3

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The estimated K_{oc} for pentasodium diethylenetriamine pentaacetate is 97.7 L/kg.

F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Pentasodium diethylenetriamine pentaacetate is not readily biodegradable and thus does meet the screening criteria for persistence.

Based on a measured log K_{ow} of -2 L/Kg, pentasodium diethylenetriamine pentaacetate does not meet the screening criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on pentasodium diethylenetriamine pentaacetate are > 0.1 mg/L. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies on pentasodium diethylenetriamine pentaacetate are > 1 mg/L. Thus, pentasodium diethylenetriamine pentaacetate does not meet the criteria for toxicity.

The overall conclusion is that pentasodium diethylenetriamine pentaacetate is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Repr. Category 1B, H360D

Acute Tox. Category 4 (Inhalation), H332

STOT RE Category 2, H373 (target organ: Respiratory Tract)

B. Labelling

Danger

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Store between 15 – 30 °C

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard for pentasodium diethylenetriamine pentaacetate in Australia is not available.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Pentasodium diethylenetriamine pentaacetate is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations. Consider the material's impact on air quality, potential migration in soil or water; effects on animal, aquatic and plant life and public health regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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Stevens, E., Rosoff, B., Weiner, M., and Spencer, H. (1962) Metabolism of the chelating agency diethylenetriamine pentaacetic acid (C^{14}DTRPA) in man. Proceed. Soc. Exp. Biol. Med. 3(22):235-238.

U.S. Environmental Protection Agency [USEPA]. (2026). Comptox Chemicals Dashboard. https://comptox.epa.gov/dashboard/chemical/details/DTXSID9027077 (accessed July 23, 2026) Diethylenetriaminepentaacetic acid pentasodium salt

POLY(VINYL ACETATE) – POLY(VINYL ALCOHOL) POLYMER

This dossier on poly(vinyl acetate)-poly(vinyl alcohol) polymer presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Poly(vinyl acetate)-poly(vinyl alcohol) polymer is a polymer of low concern. Therefore, it is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

Poly(vinyl acetate)-poly(vinyl alcohol) polymer is a vinyl polymer. Based largely on its high molecular weight, the substance is not expected to bioaccumulate or bioconcentrate. It is of low toxicity to environmental receptors and is not expected to degrade substantially under environmental conditions.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): ethenol; ethenyl acetate

CAS RN: 25213-24-5

Molecular formula: $(C_4H_6O_2.C_2H_4O)x$-[This substance is a polymer.]

Molecular weight: 130.1418 g/mol (monomer); polymer variable (UVCB)

Synonyms: Poly(vinyl acetate)-poly(vinyl alcohol) polymer; vinyl alcohol, polymer with vinyl acetate; ethanol-vinyl acetate copolymer; acetic acid ethenyl ester, polymer with ethenol

3 PHYSICO-CHEMICAL PROPERTIES

No chemical-specific information is available. Synthetic addition polymers of this type are generally high to very high molecular weight species. Water solubility is expected to be low based on the predominantly hydrophobic structure of the substance.

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 1). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for poly(vinyl acetate)-poly(vinyl alcohol) polymer.

NICNAS has assessed poly(vinyl acetate)-poly(vinyl alcohol) polymer in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and considers it a polymer of low concern and concluded that it poses no unreasonable risk to human health and the environment.[1]

Table 1 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

Polymers with a molecular weight greater than 1,000 g/mol generally have a negligible vapor pressure, which indicates that the chemical is likely to exist solely as particulate matter in the atmosphere. As particulate matter, atmospheric oxidation is not expected to be a significant route of environmental removal. Likewise, volatilization from water or moist soil is not expected to occur at an appreciable rate (USEPA, 2013).

Non-ionic polymers such as poly(vinyl acetate)-poly(vinyl alcohol) polymer are not expected to be highly soluble in water based on its predominantly hydrophobic structure. If discharged to the aquatic environment, this polymer is expected to partition to soil or sediment. It is not expected to be highly mobile if released to the soil compartment (Beothling and Nabholz, 1997).

Vinyl polymers are not expected to undergo rapid degradation. In an OECD 302B (Zahn Wellens) test carried out using poly(vinyl acetate)-poly(vinyl alcohol) polymer, the test substance was found to be less than 10 % degraded after 28 days, indicating essentially no degradation (RE) (Environment Canada, 2005). However, some bacterial species like *Pseudomonads and Sphingomanads* are known to efficiently degrade the substance. Additionally, some fungal species like *Penicillium sp.* and *Geotrichum fermentans WF9101* have also been reported to degrade the substance efficiently. Microbial enzymes like oxidase, hydrolase, and dihydrogenase play an important role in the degradation of poly(vinyl acetate)-poly(vinyl alcohol) polymer (Amann and Minge, 2012).

The high molecular weight of the polymer is expected to preclude or minimize bioaccumulation. Polymers with a number average molecular weight (NAMW) greater than 1,000 g/mol cannot cross biological membranes (Boethling and Nabholz, 1997).

[1] https://www.industrialchemicals.gov.au/chemical-information/search-assessments?assessmentcasnumber=25213-24-5%2C+

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

No data on the environmental effects of the polymer were found. However, the high molecular weight of the substance is expected to negate or limit the bioavailability of the substance thus minimizing toxic effects on environmental receptors.

B. Aquatic Toxicity

No ecotoxicity data were identified for poly(vinyl acetate)-poly(vinyl alcohol) polymer. Information on Non-Ionic Polymers Group (DoEE, 2017) is provided below.

> *"Non-ionic polymers with low water solubility, such as the methyl acrylate-vinylidene chloride copolymer, generally have low toxicity to aquatic life (Beothling and Nabholz 1997). Insoluble non-ionic polymers have low bioavailability and their adverse effects result from physical. effects such as occlusion of respiratory organs (e.g. the gills of fish). These adverse effects occur only at very high loading levels in water (Beothling and Nabholz, 1997).*
>
> *Water soluble or dispersible non-ionic polymers, such as polyacrylamide, are also typically of low concern for ecotoxicity. Non-ionic polymers with NAMW greater than 1 000 cannot be absorbed across biological membranes in aquatic organisms, and therefore toxicity only occurs through indirect effects such as chelation of essential nutrients (Beothling and Nabholz 1997). However, the structure of polyacrylamide suggests that it will have low potential to act by this mode of action. This is further supported by median effective concentration (EC50) and median lethal concentration (LC50) values available for other water soluble or dispersible non-ionic polymers, which are greater than 100 mg/L (Beothling and Nabholz, 1997).*
>
> *Water soluble or dispersible polymers with NAMW less than 1 000 Da, or significant levels of LMW substances and trapped monomers, are of potential concern because of their increased bioavailability. However, this assessment was conducted assuming that the polymers in this group have NAMW greater than 1 000 Da and the percentage of LMW species is low."*

C. Terrestrial Toxicity

No studies are available.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Poly(vinyl acetate)-poly(vinyl alcohol) polymer is not expected to be biodegradable. Thus, it meets the criteria for persistence.

Poly(vinyl acetate)-poly(vinyl alcohol) polymer is not expected to bioaccumulate. Polymers with a NAMW greater than 1,000 g/mol cannot cross biological membranes (Boethling and Nabholz, 1997). Thus, it does not meet the screening criteria for bioaccumulation.

There are no acute or chronic toxicity studies on poly(vinyl acetate)-poly(vinyl alcohol) polymer. However, the high molecular weight of the substance is expected to negate or limit the bioavailability of the substance thus minimizing toxic effects on environmental receptors. Thus, poly(vinyl acetate)-poly(vinyl alcohol) polymer does not meet the criteria for toxicity.

The overall conclusion is that poly(vinyl acetate)-poly(vinyl alcohol) polymer is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for poly(vinyl acetate)-poly(vinyl alcohol) polymer.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Poly(vinyl acetate)-poly(vinyl alcohol) polymer	25213-24-5	Not a PBT	No	Yes	Yes	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern

DoEE	Department of the Environment and Energy
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
IChEMS	Industrial Chemicals Environmental Management Standard
IMAP	Inventory Multitiered Assessment and Prioritisation
IUPAC	International Union of Pure and Applied Chemistry
kPa	kilopascal
LC	lethal concentration
mg/L	milligrams per litre
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
OECD	Organisation for Economic Co-operation and Development
PBT	Persistent Bioaccumulative Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
ThOD	Theoretical oxygen demand
USEPA	United States Environmental Protection Agency
UVCB	Unknown or Variable Composition, Complex Reaction Products and Biological Materials

POLYETHER AMINE

This dossier on poly[oxy(methyl-1,2-ethanediyl)], .alpha.-(2-aminomethylethyl)-.omega.-(2-aminomethylethoxy)- (also referred to as polyether amine) presents the most critical studies pertinent to the risk assessment of this substance in its use in coal seam and shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – polyether amine is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

Polyether amine is a polymer comprising propylene glycol monomer units with primary amine groups located on secondary carbon atoms at the end of the polyether chains. The polymer can be formulated with various number average molecular weights (Mn). Commercially, the molecular weight for the chemical usually ranges from 230 to 4000 Daltons (Da) (NICNAS, 2014).

Based on read-across, polyether amine is not readily biodegradable and has a low potential to bioaccumulate. It is not expected to sorb to soil, suspended solids or sediment.

Polyether amine has low acute and chronic toxicity to aquatic organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): 1-(2-aminopropoxy)-2-[2-(2-aminopropoxy)propoxy]propane

CAS RN: 9046-10-0

Molecular formula: $H_2N\ (C_3H_6O)_n\ C_3H_6NH_2$ with n= 2-6

Molecular weight: Variable, 230 – 4,000 g/mol

Synonyms: polyether amine; poly[oxy(methyl-1,2-ethanediyl)], .alpha.-(2-aminomethylethyl)-.omega.-(2-aminomethylethoxy)-; polypropylene glycol bis(2-aminopropyl) ether; diaminopolypropylene glycol; polypropylene glycol bis(aminopropyl) ether; polyoxypropylenediamine

3 PHYSICO-CHEMICAL PROPERTIES

Limited physico-chemical properties are available for polyether amine. Key physical and chemical properties for structural analogue 3,3'-oxybis(ethyleneoxy)bis(propylamine) (CAS RN 4246-51-9) are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of Polyether Amine

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Clear, colourless, homogeneous liquid	2	ECHA
Melting Point	-20 °C @ 101.3 kPa	2	ECHA
Boiling Point	Substance decomposes before boiling	-	ECHA
Density	1,006 kg/m^3 @ 20°C	1	ECHA
Vapor Pressure	0 Pa @ 25°C	1	ECHA
Partition Coefficient (log K_{ow})	-1.25 @ 25°C and pH 11.1	2	ECHA
Water Solubility	Miscible	2	ECHA
Dissociation constant (pKa)	10.1 @ 20°C	1	ECHA
Viscosity	13.0 mPa s @ 20°C	1	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for polyether amine.

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Based on read-across, polyether amine is not readily biodegradable and has a low potential to bioaccumulate. It is not expected to sorb to soil, suspended solids or sediment.

B. Biodegradation

In an OECD 302B test conducted on polyether amine, degradation was 17% after 28 days (ChemInfo)[1]. Similar findings were observed with read-across substance 3,3'-oxybis(ethyleneoxy)bis(propylamine). After 60 days, the observed biodegradation degree is less than 20%, therefore the test substance is regarded as not readily biodegradable (ECHA).

If a chemical is found to be not readily biodegradable, it is categorised as Persistent since its half-life is substantially greater than 60 days (DoEE, 2017).

C. Environmental Distribution

No experimental or calculated data are available for polyether amine. Estimated data for read-across substance 3,3'-oxybis(ethyleneoxy)bis(propylamine) was used.

The dissociation constant (pKa) of 10.1 for read-across substance 3,3'-oxybis(ethyleneoxy)bis(propylamine) indicates that the substance will be present as a charged molecule in the environmentally relevant pH range of pH 4 to pH 9. Cations generally adsorb stronger to soils containing organic carbon and clay than their neutral counterparts. Therefore, the adsorption coefficient was calculated according to Franco & Trapp (2008, 2009, 2010) to correct for the charged molecule at pH 5, 7, and 8. The method is based on the dissociation constant pKa and the log K_{ow} for the uncharged molecule. The resulting soil organic carbon partition coefficient (K_{oc}) at pH 5 - 8 is 14 L/kg (ECHA). Based on this K_{oc} value, if released to soil, the substance is not expected to sorb and will be mobile.

D. Bioaccumulation

There are no bioaccumulation studies on polyether amine. Based on a log K_{ow} of -1.25 in read-across substance 3,3'-oxybis(ethyleneoxy)bis(propylamine), polyether amine is not expected to bioaccumulate (ECHA).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Polyether amine has low acute and chronic toxicity to aquatic organisms.

B. Aquatic Toxicity

Acute Studies

No experimental data are available for polyether amine. was used. Table 3 lists available data for read-across substance 3,3'-oxybis(ethyleneoxy)bis(propylamine).

[1] https://recherche.chemikalieninfo.de/public/stoff/301478?dv=18&sv=

Table 3: Acute Aquatic Toxicity Studies on Polyether Amine

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Leuciscus idus (Golden orfe)	96-hr LC_{50}	>1,000	2	ECHA
Daphnia magna	48-hr EC_{50}	218	2	ECHA
Desmodesmus subspicatus	72-hr EC_{50}	>500	2	ECHA

Chronic Studies

No chronic experimental data is available for fish and invertebrates. Using QSAR, an estimated 21-day NOEC of 24.6 mg/L was derived in daphnia (ECHA). [Kl. Score = 2]

In algae, a measured 72-hr NOEC value of 15.6 mg/L has been reported (ECHA). [Kl. Score = 2]

C. Terrestrial Toxicity

No data is available.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Polyether amine is readily biodegradable and thus does not meet the screening criteria for persistence.

Based on a measured log Kow of 1.34, polyether amine does not meet the screening criteria for bioaccumulation.

There are no chronic aquatic toxicity studies on polyether amine. The acute E(L)C50 values for polyether amine are >1 mg/L for fish, invertebrates, and algae. Thus, polyether amine does not meet the screening criteria for toxicity.

The overall conclusion is that polyether amine is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for polyether amine.

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8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
Poly[oxy(methyl-1,2-ethanediyl)], .alpha.-(2-aminomethylethyl)-.omega.-(2-aminomethylethoxy)-	9046-10-0	Not a PBT	No	No	Yes	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

Department of the Environment and Energy [DoEE]. (2017). Chemical Risk Assessment Guidance Manual: for chemicals associated with coal seam gas extraction, Guidance manual prepared by Hydrobiology and ToxConsult Pty Ltd for the Department of the Environment and Energy, Commonwealth of Australia, Canberra. Available: https://www.dcceew.gov.au/water/coal-and-coal-seam-gas/national-assessment-chemicals/consultation-risk-assessment-guidance-manual

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Klimisch, H.J., Andreae, M., and Tillmann, U. (1997). A systematic approach for evaluating the quality of experimental and toxicological and ecotoxicological data. Regul. Toxicol, Pharmacol. 25:1-5.

B. Abbreviations and Acronyms

°C	degrees Celsius
AICIS	Australian Industrial Chemicals Introduction Scheme
AICS	Australian Inventory of Chemical Substances
COC	constituent of concern
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
Kl	Klimisch scoring system
kPa	kilopascal
L	litre
L/kg	litres per kilogram

LC	lethal concentration
LD	lethal dose
m^3	cubic metre
mg/kg	milligrams per kilogram
mg/L	milligrammes per litre
mg/m^3	milligrams per cubic metre
mL	millilitre
mPa s	millipascal second
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

EHS Support

POLYETHYLENE

This dossier on polyethylene presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. It does not represent an exhaustive or critical review of all available data. Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Polyethylene is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

Polyethylene is a vinyl polymer made from ethylene. It can be branched or linear. Branched or low-density polyethylene is tough and pliable but not to the same degree as linear polyethylene. Linear or high-density polyethylene has a greater hardness and tensile strength (NCBI, 2026).

Based largely on its high molecular weight, the substance is not expected to bioaccumulate or bioconcentrate. It is of low toxicity to environmental receptors and is not expected to degrade substantially under environmental conditions.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): ethene, homopolymer

CAS RN: 9002-88-4

Molecular formula: $(C_2H_4)_x$

Molecular weight: 28.05 g/mol (monomer); variable (polymer)

Synonyms: polyethylene; ethylene, polymers

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Polyethylene

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	White powder	-	NCBI, 2026
Melting Point	85-140°C (pressure not provided)	-	NCBI, 2026
Boiling Point	260°C (pressure not provided)	-	[1]
Density	910-960 kg/m^3 @ 20°C	-	NCBI, 2026
Vapor Pressure	Negligible @ 25°C	-	NCBI, 2026

[1] Ethene, homopolymer. *CAS Common Chemistry*. CAS, a division of the American Chemical Society, n.d. https://commonchemistry.cas.org/detail?cas_rn=9002-88-4 (retrieved 2026-07-25) (CAS RN: 9002-88-4). Licensed under the Attribution-Noncommercial 4.0 International License (CC BY-NC 4.0).

Property	Value	Klimisch Score	Reference
Partition Coefficient (log K_{ow})	Not available	-	-
Dissociation Constant (pKa)	Not relevant	-	-
Water Solubility	Insoluble	-	NCBI, 2026
Viscosity	Not applicable, substance is a solid	-	-

Most low-density polyethylene (LDPE) resins available in the US are ethylene homopo1ymers with a molecular weight of 100 000-500 000 and a crystallinity of about 50%. Most high-density polyethylene (HDPE) resins availab1e in the US are ethylene homopolymers with a molecular weight of several hundred thousand and a crystallinity of 75-80% (IARC, 1979).

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 1). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for polyethylene.

NICNAS has assessed polyethylene in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to human health and the environment.[2][3]

Table 1 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

Polymers with a molecular weight greater than 1,000 g/mol generally have a negligible vapor pressure, which indicates that the chemical is likely to exist solely as particulate matter in the atmosphere. As particulate matter, atmospheric oxidation is not expected to be a significant route of environmental removal. Likewise, volatilization from water or moist soil is not expected to occur at an appreciable rate (USEPA, 2013).

Non-ionic polymers such as polyethylene are not expected to be highly soluble in water based on its predominantly hydrophobic structure. If discharged to the aquatic environment, this polymer is

[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=3e4c433e-f36b-1410-8924-008e64e216c7
[3] https://services.industrialchemicals.gov.au/assessment-detail/?id=496d433e-f36b-1410-8de4-00e8f2afc108

expected to partition to soil or sediment. It is not expected to be highly mobile if released to the soil compartment (Beothling and Nabholz, 1997).

Polyethylene is not expected to undergo rapid degradation.

The high molecular weight of the polymer is expected to preclude or minimize bioaccumulation. Polymers with a number average molecular weight (NAMW) greater than 1,000 g/mol cannot cross biological membranes (Beothling and Nabholz, 1997).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

No data on the environmental effects of polyethylene were found. However, the high molecular weight of the substance is expected to negate or limit the bioavailability of the substance thus minimizing toxic effects on environmental receptors.

B. Aquatic Toxicity

No ecotoxicity data were identified for polyethylene. Information on Non-Ionic Polymers Group (DoEE, 2017) is provided below.

> *"Non-ionic polymers with low water solubility, such as the methyl acrylate-vinylidene chloride copolymer, generally have low toxicity to aquatic life (Beothling and Nabholz 1997). Insoluble non-ionic polymers have low bioavailability and their adverse effects result from physical. effects such as occlusion of respiratory organs (e.g. the gills of fish). These adverse effects occur only at very high loading levels in water (Beothling and Nabholz, 1997).*
>
> *Water soluble or dispersible non-ionic polymers, such as polyacrylamide, are also typically of low concern for ecotoxicity. Non-ionic polymers with NAMW greater than 1 000 cannot be absorbed across biological membranes in aquatic organisms, and therefore toxicity only occurs through indirect effects such as chelation of essential nutrients (Beothling and Nabholz 1997). However, the structure of polyacrylamide suggests that it will have low potential to act by this mode of action. This is further supported by median effective concentration (EC50) and median lethal concentration (LC50) values available for other water soluble or dispersible non-ionic polymers, which are greater than 100 mg/L (Beothling and Nabholz, 1997).*
>
> *Water soluble or dispersible polymers with NAMW less than 1 000 Da, or significant levels of LMW substances and trapped monomers, are of potential concern because of their increased bioavailability. However, this assessment was conducted assuming that the polymers in this group have NAMW greater than 1 000 Da and the percentage of LMW species is low."*

C. Terrestrial Toxicity

No studies are available.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Polyethylene is not expected to be biodegradable. Thus, it meets the criteria for persistence.

Polyethylene is not expected to bioaccumulate. Polymers with a NAMW greater than 1,000 g/mol cannot cross biological membranes (Boethling and Nabholz, 1997). Thus, it does not meet the screening criteria for bioaccumulation.

There are no acute or chronic toxicity studies on polyethylene. However, the high molecular weight of the substance is expected to negate or limit the bioavailability of the substance thus minimizing toxic effects on environmental receptors. Thus, polyethylene does not meet the criteria for toxicity.

The overall conclusion is that polyethylene is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for polyethylene.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Polyethylene	9002-88-4	Not a PBT	No	No	Yes	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number

COC	constituent of concern
DoEE	Department of the Environment and Energy
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
IChEMS	Industrial Chemicals Environmental Management Standard
IMAP	Inventory Multitiered Assessment and Prioritisation
IUPAC	International Union of Pure and Applied Chemistry
kPa	kilopascal
LC	lethal concentration
mg/L	milligrams per litre
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
OECD	Organisation for Economic Co-operation and Development
PBT	Persistent Bioaccumulative Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency
UVCB	Unknown or Variable Composition, Complex Reaction Products and Biological Materials

POLYETHYLENE TEREPHTHALATE

This dossier on polyethylene terephthalate (PET) presents the most critical studies pertinent to the risk assessment of this substance in its use in drilling activities. This dossier does not represent an exhaustive or critical review of all available data. Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed PET in an IMAP Tier 1 assessment and considers it a polymer of low concern[1].

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): Poly(oxy-1,2-ethanediyloxycarbonyl-1,4-phenylenecarbonyl)

CAS RN: 25038-59-9

Molecular formula: $(C_{10}H_8O_4)n$ [This substance is a polymer]

Molecular weight: Variable (UVCB)

Synonyms: polyethylene terephthalate (PET); 1,4-Benzenedicarboxylic acid, dimethyl ester, polymer with 1,2-ethanediol; 1,4-Benzenedicarboxylic acid, polymer with 1,2-ethanediol; Polyesters, polyethylene terephthalate; Ethylene glycol, polyester with terephthalic acid

SMILES: C(OCCO*)(=O)C1=CC=C(C(*)=O)C=C1

II. PHYSICO-CHEMICAL PROPERTIES

PET is the most common thermoplastic polymer resin of the polyester family (USEPA, 2023). Limited physico-chemical properties are available for this synthetic polymer which is formed from a chemical reaction between an acid (terephthalic acid) and an alcohol (ethylene glycol). In this reaction, two or more molecules combine to make a large molecule whose structure repeats throughout its length. Therefore, synthetic polymers like PET can form ion molecules that are very stable and strong (IJERT 2012). In short PET is expected to be a thermally and chemical stable synthetic polymer with a low charge density. As a polymer, PET is expected to have a high molecular weight, be hydrophobic, and oleophilic (DoEE, 2017).

Polyesters are reported to be used in the coal seam gas industry in Australia in drilling fluid formulations as bridging agents. According to industry information, bridging agents are solids which are used to plug fractured or porous rock formations in order to prevent fluid loss during drilling operations. The loss of fluid into formations during drilling results in a reduction or loss of fluids returning to the surface in a process which is referred to as lost circulation. When bridging agents are used to manage lost circulation they are referred to as lost circulation materials (LCMs). The chemical composition of LCMs is variable, but they are typically readily available solid materials which have fibrous or plate-like forms (DoEE, 2017).

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=7abc433e-f36b-1410-8de4-00e8f2afc108

Table 1: Overview of the Physico-chemical Properties of Polyethylene Terephthalate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Colourless and odorless flake	-	SDS
Melting Point	254 - 260°C (pressure not indicated)	-	SDS
Boiling Point	decomposes	-	CAS[2]
Density	1400 kg/m^3 (temperature not provided)	-	SDS
Vapor Pressure	Negligible	-	SDS
Water Solubility	Insoluble in water	-	SDS

III. ENVIRONMENTAL FATE PROPERTIES

There are limited studies on the environmental fate of PET. As a synthetic polymer it is expected to be chemically and thermally stable due to the aromatic sub-units of its polymeric structure. These protect the ester bonds from cleavage by microbial enzymes and from hydrolytic cleavage by abiotic processes. Thus, under normal environmental conditions, PET is almost impervious to hydrolytic degradation and is essentially a non-biodegradable solid (Ivanova, 2013 and DoEE, 2017).

The primary mode of degradation of PET in the environment is photodegradation, which can cause this polymer to become brittle. Following prolonged exposure to light PET and its component polymer chains are expected to disintegrate and undergo metabolism by microorganisms (DoEE, 2017). These microbes can mineralize PET plastic for their growth, energy, and nutritional purposes (Environ Chem Lett., 2022). However, the rate of degradation is very slow and strongly dependent on exposure conditions (e.g., exposure to UV light). It has recently been estimated that it can take 50 years or more for PET to fully degrade in the environment (Ivanova, 2013 and DoEE, 2017).

The high molecular weight of the polymer is expected to preclude or minimize bioaccumulation. Polymers with a number average molecular weight (NAMW) greater than 1,000 g/mol cannot cross biological membranes (Boethling and Nabholz, 1997).

IV. HUMAN HEALTH HAZARD ASSESSMENT

These polymers are considered chemically and biologically inert. As such, limited toxicity studies relevant to human health have been identified in literature.

As a polymer of low concern, PET poses no unreasonable risk to human health based on Tier I assessment under the NICNAS IMAP assessment framework[2]. Similarly, based on an assessment of human health hazards, NICNAS identified polyester, thereby PET, as a chemical of low concern for human health (NICNAS, 2017). Chemicals of low concern are unlikely to have adverse effects upon exposure if they are released to the environment from coal seam gas operations.

[2] CAS Common Chemistry. CAS, a division of the American Chemical Society, n.d. https://commonchemistry.cas.org/detail?cas_rn=25038-59-9 (retrieved 2023-09-07) (CAS RN: 25038-59-9). Licensed under the Attribution-Noncommercial 4.0 International License (CC BY-NC 4.0).

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

No toxicological reference values or drinking water guidance values were developed.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

PET does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

PLCs without significant ionic functionality are of low concern to the aquatic environment (DoEE, 2017). As noted earlier, these polymers are considered chemically and biologically inert. As such, no ecotoxicity data was identified for PET. Information on the Polyester Group (DoEE, 2017) is provided below.

> *"Synthetic polymers that are stable in the environment, that have high molecular weight and low charge density, and that do not swell in water generally pose a low risk of causing direct ecotoxicological effects in the environment. For polyesters with these properties, adverse effects are typically only expected to occur in the environment as a result of physical effects, such as the blocking of respiratory organs (Boethling and Nabholz 1997).*
>
> *Polyesters may pose an ecotoxicity concern if they are water soluble or dispersible and they have high cationic charge density. Water soluble cationic polymers have the potential to adsorb to anionic biological membranes of aquatic organisms, which can cause various toxic effects (Boethling and Nabholz 1997). Polyesters that rapidly degrade into low molecular weight species may also pose a concern as low molecular weight degradants are generally more bioavailable than the parent polymers. If degradation of such polyesters results in release of chemical species that are persistent, bioaccumulative, and toxic (PBT), they may be considered of high concern to the environment. Polyethylene terephthalate does not present any of these hazards."*

B. Calculation of PNEC

Due to the lack of relevant toxicity data, no PNECs were calculated.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

PET is a high molecular weight, stable, insoluble polymer. It is not expected to be readily biodegradable, thus it meets the screening criteria for persistence.

The high molecular weight of this polymer is expected to preclude or minimize bioaccumulation. Thus, it does not meet the criteria for bioaccumulation.

There are no aquatic toxicity studies on PET. It is expected to have low concern for aquatic toxicity because of its very high molecular weight and poor water solubility. Thus, the copolymer does not meet the criteria for toxicity.

The overall conclusion is that PET is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Not classified.

B. Labelling

None

C. Pictogram

None

X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

There are no workplace exposure standards for polyethylene terephthalate in Australia.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

PET is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed

XIII. REFERENCES

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Klimisch, H.J., Andreae, M., and Tillmann, U. (1997). A systematic approach for evaluating the quality of experimental and toxicological and ecotoxicological data. Regul. Toxicol. Pharmacol. 25:1-5.

National Industrial Chemicals Notification and Assessment Scheme [NICNAS]. (2017). Chemicals of low concern for human health based on an initial assessment of hazards, Project report prepared by the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) as part of the National Assessment of Chemicals Associated with Coal Seam Gas Extraction in Australia, Commonwealth of Australia, Canberra. Available: https://www.dcceew.gov.au/sites/default/files/documents/technical-report-number-11-chemicals-low-concern.pdf

U.S. Environmental Protection Agency [US EPA]. (2023). Comptox Chemicals Dashboard. https://comptox.epa.gov/dashboard/chemical/details/DTXSID10872790 (accessed September 7, 2023) Polyethylene terephthalate

POLYOXYETHYLENE NONYLPHENOL ETHER
[NONYLPHENOL, ETHOXYLATED]

This dossier on polyoxyethylene nonylphenol ether (also referred to as nonylphenol, ethoxylated or NPE) presents the most critical studies pertinent to the risk assessment of this substance in its use in coal seam gas extraction activities. It does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the NICNAS environmental and human health tier II assessments for the NPE group (NICNAS, 2018 and 2019) and from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – NPE was not identified in chemical databases used by NICNAS as an indicator that the chemical is of concern and is not a PBT substance. NPE was assessed as a tier 2 chemical for acute and chronic toxicity. NPE rapidly degrades in the environment with some degradants assessed as tier 3 for acute and chronic toxicity. However, these degradants are also not persistent in the environment. Therefore, NPE is classified overall as a **tier 2** chemical and requires a hazard assessment and qualitative assessment of risk.

1 BACKGROUND

NPE is a non-ionic surfactant used as a detergent, emulsifier, wetting agent, or defoaming agents. Nonylphenol ethoxylates are produced by polymerisation of ethylene oxide (oxirane, CAS RN 75-21-8) with nonylphenols, which results in a mixture of substances with linear ethoxy ether chains of various lengths depending on reaction conditions. The general formula for the NPE group is $C_{15}H_{24}(C_2H_4O)_n$; where 'n' is the number of ethylene oxide (EO) units attached to the phenol ring and can vary from 1–120. The nonylphenol ethoxylates differ by the length of the EO chain, which also contributes to different physicochemical properties and the degree of toxicity (NICNAS, 2019).

NPE degrades readily and is not expected to bioaccumulate. NPE exhibits low to moderate oral acute toxicity and low dermal toxicity. Skin irritation studies in rabbits with some NPEs have shown moderate to severe irritation. It is not a skin sensitiser. The available studies with various NPEs indicate that the level of eye irritation generally increases with decreasing EO chain length. No dermal or inhalation repeat dose studies were available but oral repeat does studies do not suggest that NPE causes serious damage to health. The substance is not genotoxic or carcinogenic. Based on the available data and considering the routes of exposure relevant for humans (excluding spermicide use), a conclusion on the reproductive and developmental toxicity of NPE cannot be derived.

NPE is of moderate toxicity concern to aquatic and terrestrial receptors.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Poly(oxy-1,2-ethanediyl), .alpha.-(nonylphenyl)-.omega.-hydroxy-

CAS RN: 9016-45-9

Molecular formula: $C_{39}H_{72}O_{13}$ (can vary based on length of ethoxy ether chain)

Molecular weight: 748.98 g/mol (can vary based on length of ethoxy ether chain)

Synonyms: polyoxyethylene nonylphenol ether; nonylphenol, ethoxylated; nonylphenol ethoxylate; 2-[2-(4-Nonylphenoxy)ethoxy]ethanol; ethoxylated nonylphenol; polyethylene glycol nonylphenyl ether

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Polyoxyethylene Nonylphenol Ether

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	liquid	2	ECHA
Melting Point	> 42 - < 44°C (pressure not provided)	2	ECHA
Boiling Point	> 295 - < 320°C (pressure not provided)	2	ECHA
Density	1,020 – 1,030 kg/m³ @ 25°C	-	Environment Canada, 2001
Vapor Pressure	140 Pa @ 25°C	2	ECHA
Partition Coefficient (log K_{ow})	3.70 @ 25°C	2	ECHA
Water Solubility	153 g/L @ 20°C	2	ECHA
Dissociation constant (pKa)	Not available	-	ECHA
Viscosity	Not available	-	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia or internationally for NPE (CAS RN 9016-45-9). In the EU, the NPE group with the general formula $C_{15}H_{24}(C_2H_4O)_n$ is restricted from use in textile articles at concentrations greater than 0.1%.

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

NPE is readily biodegradable, and it is not expected to bioaccumulate. It has a low potential to adsorb to soil or sediment.

B. Biodegradation.

NPE is readily biodegradable. There was 96% degradation of NPEs after 30 days, indicating substantial primary biodegradation. The biodegradation process generated degradants nonylphenol mono- and di-ethoxylates, nonylphenoxy acetate and nonylphenol mono-ethoxyacetate, some of which remained at the end of 30 days (ECHA). [KI. Score = 2]. These degradants are expected to be ultimately biodegraded in the environment (NICNAS, 2018). This is supported by Staples et al (2001),[1] who determined half-lives for NPEs and their metabolites ranging from about one to four weeks and concluded that these substances lacked persistence in the environment.

If a chemical is found to be readily or inherently biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

No sediment or soil partitioning data were found. If released to soil, NPE is expected to have low potential for adsorption and a high potential for mobility. If released to water, long chain nonylphenol ethoxylates are expected to remain in water as they have high water solubility and low volatility. Thus, it is expected that NPE has a low potential for adsorption to suspended solids or sediment. Water soluble degradation products, nonylphenol ethoxyacetates, are also expected to remain in water (NICNAS, 2018).

[1] Referenced by Canadian Categorization Results from the Canadian Domestic Substance List https://canadachemicals.oecd.org/ChemicalDetails.aspx?ChemicalID=ECD1874C-5A14-4C9A-BC22-1BA439746EA9

D. Bioaccumulation

NPE is a surfactant and most surfactants tend to be retained on epithelial surfaces, rather than cross cellular membranes and bioaccumulate (de Oude, 1992; McWilliams and Payne, 2001). Hence, bioaccumulation for most classes of surfactants is generally below the level for concern (McWilliams and Payne, 2001). As a result, NPE is expected to have low bioaccumulation potential in aquatic organisms. The BCF in the fish *Cyprinus carprio* of NPEs was reported to be <0.2 L/kg at 2 mg/L and <1.4 L/kg at 0.2 mg/L (NICNAS, 2018).

6 HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Most of the human and animal data available for NPE were from studies conducted using NPEs with 1–50 EO units. NPEs metabolise in the body and biodegrade in the environment to nonylphenols (NPs). Therefore, toxicity of NPs was considered acceptable to derive the toxicity of the ethoxylates when there were no hazard data available on specific systemic endpoints. It is noted that compared with NPEs, NPs are more toxic (NICNAS, 2019).

NPE exhibits low to moderate oral acute toxicity and low dermal toxicity. Skin irritation studies in rabbits with some NPEs have shown moderate to severe irritation. It is not a skin sensitiser. The available studies with various NPEs indicate that the level of eye irritation generally increases with decreasing EO chain length. No dermal or inhalation repeat dose studies were available but oral repeat does studies do not suggest that NPE causes serious damage to health. The substance is not genotoxic or carcinogenic. Based on the available data and considering the routes of exposure relevant for humans (excluding spermicide use), a conclusion on the reproductive and developmental toxicity of NPE cannot be derived. However, NPs are classified for reproductive and developmental toxicity based on animal data.

B. Acute Toxicity

Oral

The acute oral toxicity of NPEs could range from low to moderate. The toxicity of NPEs is considered to increase with decreasing EO units (or chain length) (Environment Canada, 2002 as cited in NICNAS, 2019). For NPE the oral LD50 was reported to be 1310 mg/kg bw in rats (HSDB). However, the CAS RN for NPE applies to many NPEs containing 1–120 EO units. The following LD50s were reported for NPEs of various EO chain lengths (NICNAS, 2019):

- 3500–4500 mg/kg bw in rats for NPEs with EO units 2, 5, 7 or 9;
- 2000–4290 mg/kg bw in mice, guinea pigs and rabbits for an NPE with 9 EO units;
- 1300 mg/kg bw in rats for an NPE with 10 EO units; and
- other NPEs with 30 EO units were reported as 'relatively harmless' in rats but no LD_{50}s were determined.

Reported signs of toxicity included diarrhoea, tremors, prostration and narcosis. Necropsy revealed congested lungs, gastrointestinal system, and kidneys (CIR, 1983 as cited in NICNAS, 2019).

Inhalation

The limited data available are not sufficient to derive a conclusion on the acute inhalation toxicity of the chemicals.

In an acute inhalation study, male rats were exposed (whole body) to undiluted or 1 % NPEs (with 4, 7 or 9 EO units) for either four or eight hours and observed for 14 days. The exposure concentrations were not reported. No toxic effects were observed (CIR, 1983 as cited in NICNAS, 2019).

In a 4-hour acute inhalation study, Sprague Dawley (SD) rats were exposed (whole body) to aerosolised detergent (containing NPE as the principal component) at concentrations of 0.50, 0.90 or 1.41 mg/L. Sub-lethal effects included eye and respiratory irritation, hypoactivity, laboured and audible breathing, unkempt fur, and distended abdomens. At two weeks post-exposure, the animals showed body weight loss or decreased weight gain, and perinasal encrustation. The LC_{50} was reported as 1.60 g/m^3 (CalEPA, 2010 as cited in NICNAS, 2019).

Dermal

Based on the limited data available, the chemicals are expected to have low acute dermal toxicity. The dermal LD_{50} for NPE was reported to be 2000 mg/kg bw in rabbits (NICNAS, 2019).

C. Irritation

Skin

Skin irritation studies in rabbits with some NPEs have shown moderate to severe irritation. The degree of irritation changes with the number of EO units (NICNAS, 2019).

In a skin irritation study in New Zealand White (NZW) rabbits, 11 NPEs (with EO units 2, 4, 6, 7, 9, 10, 12, 13, 15, 30 or 40) were tested undiluted by applying occlusive patches of 0.01–0.50 mL. The NPEs with EO chains ≤6 caused moderate to severe irritation (CIR, 2015 as cited in NICNAS, 2019).

Severe skin irritation effects were observed in animals tested with NPEs containing five or six EO units. In a skin irritation study, an NPE containing six EO units (NPE-6) was applied (occlusively, 0.5 mL) to the clipped intact and abraded skin of six rabbits. The effects (erythema and oedema) were scored at 24 and 72 hours after application. The chemical was classified as severely irritating to the skin of rabbits, with a primary irritation index (PII) of 3.0. A PII of 6.6 was reported in another skin irritation study with NPE-6 (animal species and experimental details not stated) (CIR, 1999 as cited in NICNAS, 2019).

However, NPEs with an EO) chain of > 30 are slightly irritation or non-irritating (Talmage, 1994).

Eye

The available studies with various NPEs indicate that the level of irritation generally increases with decreasing EO chain length (NICNAS, 2019).

In a study conducted according to the Draize method, an NPE with six EO units caused severe eye irritation in rabbits. The average scores obtained on days one and seven post-exposure were 28.8 and 16.0, respectively (maximum score=110) (CIR, 1999 as cited in NICNAS, 2019).

In studies involving the instillation of 0.1 mL of an undiluted NPE solution to the eyes of rabbits, NPEs with chains of 2 to 15 were moderately to severely irritating. NPEs with EO chains of >30 were non-irritating (ECHA) [Kl. Score = 2].

D. Sensitisation

Based on the available data, NPEs and their anionic surfactant derivatives are generally not considered to have skin sensitisation potential.

In a guinea pig maximisation test, five albino guinea pigs were exposed intradermally to NPE containing six EO units (NPE-6) at concentrations of 0, 1.7, 3.0, 9.0 or 27 % (w/w) during the induction phase. After seven days, undiluted NPE-6 was applied topically, and the site occluded for 48 hours. The application site was later challenged topically with 2.7 % NPE-6. No dermal responses were observed after 48 hours following the challenge (ECHA) [Kl. Score = 2].

E. Repeated Dose Toxicity

Oral

In several 90-day repeated dose oral toxicity studies (individual test protocols), NPEs containing 4, 6, 15, 20, 30 or 40 EO units were orally administered to rats in the diet at 40–5000 mg/kg bw/day (0.01–1% of the diet). Growth retardation due to poor palatability of the diets was observed with NPEs containing 4, 6, 15 and 20 EO units at > 200 mg/kg bw/day. Increased absolute and relative liver weights were observed when animals were administered NPE-4 or NPE-6 at 200 mg/kg bw/day, but no histopathological changes were observed. No effects were observed in rats that ingested NPE-30. Slight hepatic necrosis and centrilobular granular degeneration were observed in rats administered NPE-40 at a 3 % dietary concentration (~700 mg/kg bw/day) (CIR, 1983; Danish EPA, 2000 as cited in NICNAS, 2019).

In 2-year repeated dose oral toxicity studies, NPE-4 and NPE-9 were administered to rats at doses of ~400–1000 mg/kg bw/day. In rats, reduced body weights and enlarged livers were observed at doses > 1000 mg/kg bw/day. The authors concluded that these NPEs had low chronic toxicity (CIR, 1983 as cited in NICNAS, 2019).

In another study using NPE-9 in rats, enlarged livers were accompanied by cloudy swelling and reduced polysaccharides at the 250 mg/kg bw/day dose, and focal hepatic cell necrosis at the 1250 mg/kg bw/day dose (Danish EPA, 2000 as cited in NICNAS, 2019).

In repeated dose oral toxicity study, mice were administered NPE-10 in the diet at doses of 0, 500, 1500 or 4500 ppm (0, 81.5, 254 or 873 mg/kg bw/day) for 104 weeks. At the highest dose, decreased body weight gain, decreased absolute liver and kidney weights, and increased relative brain, liver and kidney weights were observed. No other significant effects attributed to the chemical were

observed (CIR, 2015 as cited in NICNAS, 2019). The no observed adverse effect level (NOAEL) for NPE-10 was determined as 254 mg/kg bw/day.

Inhalation

No data are available.

Dermal

No data are available.

F. Genotoxicity

Based on the available *in vitro* genotoxicity data, NPEs are not considered to be genotoxic.

NPEs with EO chains of 9 and 30 were not mutagenic to S. typhimurium strains TA 1535, TA 1537, TA 98, and TA 100 in the absence or presence of metabolic activation (ECHA) [Kl. Score = 2].

Negative results were also obtained for NPEs in several in vitro assays reported in NICNAS (NICNAS, 2019):

- NPE-4, NPE-9 and NPE-10 were negative in Ames tests, with or without metabolic activation;
- NPE-9 did not induce unscheduled DNA synthesis in adult rat hepatocytes at concentrations up to 25 µg/mL;
- NPE-9 did not induce malignant transformations in rat liver T51B cells or mouse IOT1/2 fibroblast cells, when cultured; and
- neither NPE-9 nor NPE-40 induced malignant transformations in mouse BALB/3T3 fibroblasts.

No *in vivo* genotoxicity data are available for NPEs.

G. Carcinogenicity

Based on the available data, NPEs are not considered to be carcinogenic.

In a carcinogenicity study, female mice (n = 50/dose) were administered NPE-10 (NPE with 10 EO units) in the diet at doses of 0, 500, 1500 or 4500 ppm (0, 81.5, 254 or 873 mg/kg bw/day) for 104 weeks. No increase in the incidence of neoplastic or non-neoplastic lesions was observed at any dose level. The authors concluded that NPE-10 was not carcinogenic (CIR, 2015 as cited in NICNAS, 2019).

In another carcinogenicity study, rats were administered NPE-9 (NPE with 9 EO units) intravaginally at doses of 0, 6.7 or 33.6 mg/kg bw/day, 3 times a week for 24 months. The administered doses were equivalent to 4 or 20 times the clinical dose, respectively. No significant differences (including masses or mortalities) compared with controls were observed. Positive observations (details not available) in the experimental groups at necropsy were considered to be related to ageing. The authors concluded that NPE-9 was 'neither toxic nor carcinogenic in this lifetime exposure study, even at a dose that was 20 times that recommended for humans' for use as a spermicide (CIR, 1999 as cited in NICNAS, 2019).

In 2-year carcinogenicity studies, NPE-4 and NPE-9 were administered orally to rats at doses of 200 and 140 mg/kg bw/day. No increase in the frequency of tumours was reported (Danish EPA, 2000 as cited in NICNAS, 2019).

H. Reproductive Toxicity

Studies are available only for NPE-9, NPE-10, NPE-30. No data are available for the other chemicals in this group.

The chemical NPE-9 is a known spermicide and the studies available using NPE-9 have reported reproductive toxicity effects in rats from doses of 50 mg/kg bw/day, when administered intravaginally. However, oral studies in rats with NPE-9 showed reproductive and developmental effects only at a dose of 250 mg/kg bw/day. Based on the available data and considering the routes of exposure relevant for humans (excluding spermicide use), a conclusion on the reproductive and developmental toxicity of NPEs cannot be derived. However, NPs are classified for reproductive and developmental toxicity based on animal data (NICNAS, 2019).

In an in vivo sperm abnormality assay, male mice (n = 5/sex/dose) were injected intraperitoneally with NPE-9 in distilled water at doses of 0, 20, 40, 50 or 60 mg/kg bw/day for five days. No increase in the frequency of morphologically abnormal sperm was observed compared with controls (CIR, 1999 as cited in NICNAS, 2019).

In a reproductive toxicity study to evaluate embryotoxicity of NPE-9, nulliparous female Wistar rats were intravaginally administered the chemical at 5 mg/100 g bw (50 mg/kg bw) on gestation days (GD) three or seven. Ulcerative vaginitis and perivaginal oedema were observed in the dams, but were reversible by GD 15. Significant differences in the mean number of normal implantation sites and the number of resorption sites were observed in dams (NICNAS, 2019).

In another study, pregnant Wistar rats were intravaginally administered NPE-9 at 25 mg/kg bw/day on GD 1–10. Increased incidences of nonpregnancies and resorptions were observed in dams administered the chemical on GD 3–6, and a significantly reduced number of live foetuses in dams was observed when the chemical was administered on GD 4, 5, and 9. The chemical NPE-9 was reported to be embryo lethal and foeticidal, but not teratogenic when administered intravaginally (CIR, 2015 as cited in NICNAS, 2019).

In an oral developmental toxicity study, female rats were administered NPE-9 at doses up to 500 mg/kg bw/day on GD 6–15. The no observed effect level (NOEL) was determined as 50 mg/kg bw/day based on reproductive and developmental effects (increased pre-implantation losses, skeletal anomalies in the litters) observed at doses > 250 mg/kg bw/day. The same authors conducted a dermal study in female mated rats with NPE-9 at doses of 50 or 500 mg/kg bw/day. No treatment-related effects on the skeletal or soft tissues were observed. However, an increased incidence of extra ribs was observed at 50 mg/kg bw/day (CIR, 1999 as cited in NICNAS, 2019).

In a developmental toxicity study, female mice were administered oral gavage doses of NPE-10 at 600 mg/kg bw/day on GD 6–13. No developmental toxicity effects were observed (CIR, 1999). Repeated subcutaneous administration of NPE-10 in female rats (from birth to day 21 after the birth of F1 offspring) at up to 80 mg/kg bw/day did not cause teratogenic effects. However, the treatment

affected the growth of the offspring, e.g., decreased body weight or tendency to decrease body weight from day seven after birth (CIR, 2015 as cited in NICNAS, 2019).

Studies with NPE-30 have shown no treatment-related effects in female rats at oral doses up to 1000 mg/kg bw/day on GD 6–15 (HSDB as cited in NICNAS, 2019).

I. Developmental Toxicity

In an oral developmental toxicity study, female rats were administered NPE-9 at doses up to 500 mg/kg bw/day on GD 6–15. The NOEL was determined as 50 mg/kg bw/day based on reproductive and developmental effects (increased pre-implantation losses, skeletal anomalies in the litters) observed at doses ≥ 250 mg/kg bw/day. The same authors conducted a dermal study in female mated rats with NPE-9 at doses of 50 or 500 mg/kg bw/day. No treatment-related effects on the skeletal or soft tissues were observed. However, an increased incidence of extra ribs was observed at 50 mg/kg bw/day (CIR, 1999 as cited in NICNAS, 2019).

In a developmental toxicity study, female mice were administered oral gavage doses of NPE-10 at 600 mg/kg bw/day on GD 6–13. No developmental toxicity effects were observed (CIR, 1999 as cited in NICNAS, 2019). Repeated subcutaneous administration of NPE-10 in female rats (from birth to day 21 after the birth of F1 offspring) at up to 80 mg/kg bw/day did not cause teratogenic effects. However, the treatment affected the growth of the offspring, e.g., decreased body weight or tendency to decrease body weight from day seven after birth (CIR, 2015 as cited in NICNAS, 2019).

Studies with NPE-30 have shown no treatment-related effects in female rats at oral doses up to 1000 mg/kg bw/day on GD 6–15 (HSDB as cited in NICNAS, 2019).

The metabolites, NP and OP, have measured oestrogenic activity. Assessment of NP suggested that developmental effects may derive from antiandrogenic activity (NICNAS, 2019).

J. Derivation of Toxicological Reference and Drinking Water Guidance Values

The toxicological reference values developed for NPE follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

Non-Cancer

A two-year dietary study has been conducted in mice with NPE-10. At the highest dose, decreased body weight gain, decreased absolute liver and kidney weights, and increased relative brain, liver and kidney weights were observed. The NOAEL was determined as 254 mg/kg bw/day. The NOAEL from this repeat dose study will be used to derive an oral reference dose (RfD) and drinking water guideline value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 1
UF_D (database uncertainty) = 1
Oral RfD = 254/ (10 x 10 x 1 x 1 x 1) = 254/100 = 2.54 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (2.54 x 70 x 0.1)/2 = 8.9 mg/L

Cancer

Based on the available data, NPE is not considered to be carcinogenic. Thus, a cancer reference value was not derived.

K. Human Health Hazard Assessment of Physico-Chemical Properties

NPE does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

7 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

NPE is of moderate toxicity concern to aquatic and terrestrial receptors.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies on NPE. NPEs rapidly degrade to more toxic common degradants, some of which possess estrogenic activity. As a result, for completeness, data for nonylphenol monoethoxylate (CAS RN 27986-36-3), which is a common degradant of the chemicals in this group and the most toxic member of the group, are also presented. As noted earlier, these degradants are also biodegradable and not persistent.

Table 3 Acute Aquatic Toxicity Studies on Polyoxyethylene Nonylphenol Ether

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Pimephales promelas (Fathead minnow)	95-hr LC_{50}	0.218*	-	NICNAS, 2018
Lepomis macrochirus (Bluegill)	96-hr LC_{50}	1.3**	-	NICNAS, 2018
Ceriodaphnia dubia (Water flea)	48-hr EC_{50}	0.328*	-	NICNAS, 2018
Daphnia magna	48-hr LC_{50}	21***	-	NICNAS, 2018
Daphnia magna	48-hr LC_{50}	1.8**	2	ECHA****
Raphidocelis subcapitata	48-hr EC_{50}	20-50**	2	ECHA
Raphidocelis subcapitata	96-hr EC_{50}	12**	-	ECOTOX[2]

* data for nonylphenol monoethoxylate (CAS RN 27986-36-3) **data for NPE
***data for nonylphenol ethoxy ether sulfate sodium salt (CAS RN 9014-90-8)
**** Values from Q(SAR) prediction model

Chronic Studies

Fish studies were not available for NPE. Based on chronic toxicity studies from degradant nonylphenol monoethoxylate (CAS RN 27986-36-3), the 21-day NOEC for Oncorhynchus mykiss (Rainbow trout) is 0.048 mg/L.

The 6-d NOEC for NPE from a chronic study on invertebrates (*Daphnia Magna*) is 1.0 mg/L. Based on chronic toxicity studies from degradant nonylphenol monoethoxylate (CAS RN 27986-36-3), the 7-day NOEC for *Ceriadaphnia dubia* is 0.285 mg/L (NICNAS, 2018).

The 96-hr NOEC from an algal (*Pseudokirchneriella subcapitata*) is 8 mg/L for NPE while a 72-hr NOEC from *Pseudokirchneriella subcapitata* is 0.14 mg/L for nonylphenol ethoxy ether sulfate sodium salt (CAS RN 9014-90-8) (NICNAS, 2018).

[2] https://cfpub.epa.gov/ecotox/search.cfm

Both NPs and short-chain NPEs have been reported to have endocrine activity and cause toxic effects in the reproductive systems of organisms, with NPEs having less activity than NPs (NICNAS, 2018).

C. Terrestrial Toxicity

No terrestrial toxicity data was available for NPE. In sediment, the 48-hr LC_{50} to the *Capitella capitata* (Gallery worm) is 3.26 mg/L (NICNAS, 2018).

D. Derivation of PNECs

PNEC water

Experimental results are available for three trophic levels. Using data from studies on NPE and read-across from the more toxic degradant, acute E(L)C50 values are available for fish (0.218 mg/L), invertebrates (0.328 mg/L) and algae (12 mg/L). Results are also available from chronic studies on three trophic levels, with NOEC values for fish (0.048 mg/L), invertebrates (0.285 mg/L) and algae (0.14 mg/L). On the basis that the data consists of short-term results from three trophic levels and long-term results from three trophic levels, an assessment factor of 10 has been applied to the lowest reported NOEC value of 0.048 mg/L for fish. The $PNEC_{water}$ is 0.0048 mg/L. This is more conservative approach than deriving a $PNEC_{water}$ based on aquatic toxicity data on NPE alone.

PNEC sediment

There are limited toxicity data for sediment-dwelling organisms. In addition, no sediment or soil partitioning data were found. Thus, the equilibrium partitioning method cannot be used to calculate the $PNEC_{sediment}$. Based on its properties, NPE is not expected to significantly adsorb to sediment and is subject to rapid degradation. Some of the degradants are highly toxic to aquatic organisms. Therefore, the assessment of this compartment will be covered by the aquatic assessment.

PNEC soil

There are no toxicity data for terrestrial or soil organisms. In addition, no sediment or soil partitioning data were found. Thus, the equilibrium partitioning method cannot be used to calculate the $PNEC_{soil}$. Based on its properties, NPE is not expected to significantly adsorb to soil and is subject to rapid degradation. Some of the degradants are highly toxic to aquatic organisms. Therefore, the assessment of this compartment will be covered by the aquatic assessment.

8 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

NPE is readily biodegradable and thus does not meet the screening criteria for persistence.

The measured BCF values in fish for NPE are < 150 L/Kg; thus, NPE does not meet the screening criteria for bioaccumulation.

Based on available chronic aquatic toxicity data, NOEC values are >0.1 mg/L for NPE. Acute E(L)C_{50} values for NPE are also >1 mg/L. Thus, NPE does not meet the criteria for toxicity.

The overall conclusion is that NPE is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for NPE.

9 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Polyoxyethylene nonylphenol ether	9016-45-9	Not a PBT	No	No	No	No	No	No	2 (fish & inv), 1 (algae)	2 (inv), 1 (algae)	2

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework). Tiering based on available data for NPE and considers rapid biodegradation.

3 - Tier 2 – Tier 2 - Hazard Assessment and Qualitative Assessment Only. Develop toxicological profile and PNECs for water and soil and provide qualitative discussion of risk.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

10 REFERENCES, ABBREVIATIONS AND ACRONYMS

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICIS	Australian Industrial Chemicals Introduction Scheme
AICS	Australian Inventory of Chemical Substances
COC	constituent of concern
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
Kl	Klimisch scoring system
KOCWIN™	USEPA organic carbon partition coefficient estimation model
kPa	kilopascal
L	litre
L/kg	litres per kilogram
LC	lethal concentration
LD	lethal dose
m^3	cubic metre
MCI	molecular connectivity index
mg/kg	milligrams per kilogram
mg/L	milligrammes per litre
mg/m^3	milligrams per cubic metre
mL	millilitre
mN/m	millinewtons per metre
mPa s	millipascal second
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
NPE	nonylphenol ethoxylates
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
ppm	parts per million

REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

POLYPROPYLENE GLYCOL
POLYPROPYLENE

This dossier on polypropylene glycol (PPG) and similar polymer polypropylene presents the most critical studies pertinent to the risk assessment of these chemicals in their use in coal seam gas extraction activities. Information provided within this dossier is based primarily on PPG.

This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Polypropylene glycol and polypropylene are classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

Polypropylene glycol or polypropylene oxide is the polymer of propylene glycol. Chemically, it is a polyether, and, a polyalkylene glycol. PPG is a liquid at room temperature. Solubility in water decreases rapidly with increasing molar mass. PPG is less toxic than polyethylene glycol (PEG) so biotechnologicals are now produced in PPG.

PPG is an organic substance that biodegrades readily, not expected to bioaccumulate, and has a low potential to adsorb to soil. PPG is of low acute toxicity concern to aquatic and terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): 2-(2-hydroxypropoxy)propan-1-ol

CAS RN: 25322-69-4

Molecular formula: $C_6H_{14}O_3$

Molecular weight: 134.17 g/mol

Synonyms: 2-(2-hydroxypropoxy)propan-1-ol, Polypropylene glycol, 2-(2-hydroxypropoxy)-1-propanol, polyoxypropylene glycol, methyloxirane homopolymer, polyoxypropylene

Chemical Name (IUPAC): 12-[(2S,3R)-3-octyloxiran-2-yl]dodecanoic acid

CAS RN: 9003-07-0

Molecular formula: $(C_3H_6)_n$ (monomer); $C_{22}H_{42}O_3$ (polymer)

Molecular weight: 354.6 g/mol (polymer)

Synonyms: Polypropylene; 1-propene,homopolymer; propene polymers

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Polypropylene Glycol (CAS RN 25322-69-4)

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Viscous colourless homogenous liquid	2	ECHA
Melting Point	No freezing down to -150°C	1	ECHA
Boiling Point	287.6°C @101.3 kPa	1	ECHA
Density	1012 kg/m^3@ 20°C	1	ECHA
Vapor Pressure	0.0839 Pa @ 20°C	1	ECHA
Partition Coefficient (log K_{ow})	0.01 @ 25°C	2	ECHA
Dissociation constant (pKa)	14.1 to 14.7 @ 25°C	2	ECHA
Water Solubility	47 g/L at 22°C	1	ECHA
Viscosity	78.34 mPa s @20°C	1	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for polypropylene glycol.

NICNAS has assessed polypropylene as a low concern polymer for the environment and as such it poses no unreasonable risk to the environment.[1]

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=566d433e-f36b-1410-8de4-00e8f2afc108

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

PPG is an organic substance that biodegrades readily, is not expected to bioaccumulate and has a low potential to adsorb to soil.

B. Biodegradation

PPG has been determined to be readily biodegradable via an OECD Guideline 301 F test. After 28 days, 86.6% of the test substance had been degraded in a manometric respirometry test (ECHA) [KI Score = 2]. If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

No experimental adsorption/desorption data are available for PPG. However, the estimated soil organic carbon partition coefficient (K_{oc}) values for homologous components of this UVCB substance range from 1 to 10 L/kg for the lowest (least sorptive) and highest (most sorptive) molecular weight homologues. The components of this UVCB substance can be regarded as having low affinity for adsorption to soils and activated sludge biosolids (ECHA).

D. Bioaccumulation

Based on a log K_{ow} of <=3 and relatively high water solubility, PPG is not expected to bioaccumulate.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

PPG is of low acute toxicity concern to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 presents the results of acute aquatic toxicity studies on PPG.

Table 3 Acute Aquatic Toxicity Studies on PPG

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Danio rerio	96-hour LC_{50}	>100	1	ECHA
Daphnia magna	48-hour EC_{50}	105.8	1	ECHA
Desmodesmus subspicatus	72-hour EC_{50}	>100	1	ECHA

Chronic Studies

No studies are available for PPG. Chronic toxicity to invertebrates of the structurally related substance D-Glucitol (Sorbitol), propoxylated (CAS RN 52625-13-5) has been investigated in a

reproduction test with *Daphnia magna f*ollowing the OECD guideline 211 using semi-static exposure. No effects were observed at the maximum concentration test (10 mg/l) and the NOEC are reported at 10 mg/l (nominal) for reproduction and mortality (ECHA) [Kl. Score = 1].

C. Terrestrial Toxicity

No data are available. The substance has a low potential for adsorption and is readily biodegradable. Therefore, significant exposure to the soil or sediment organisms is not expected (ECHA).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

PPG is readily biodegradable; thus, it does not meet the screening criteria for persistence.

No data are available on bioaccumulation. However, based on the low log K_{ow}, and rapid degradation rate, and significant water solubility, bioaccumulation is not expected.

No chronic toxicity studies are available for PPG. The NOEC values for a structurally related substance [D-Glucitol (Sorbitol), propoxylated (CAS# 52625-13-5)] are >0.1 mg/L for invertebrates. The acute E(L)C_{50} values of PPG are >1 mg/L for fish, invertebrates and algae. Thus, PPG does not meet the criteria for toxicity.

PPG is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for polypropylene glycol.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Polypropylene glycol	25322-69-4	Not a PBT	No	No	No	No	No	No	1	1	1
Polypropylene	9003-07-0	Not a PBT	No	Yes	Yes	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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Klimisch, H. J., Andreae, M., and Tillmann, U. (1997). A systematic approach for evaluating the quality of experimental and toxicological and ecotoxicological data. *Regul. Toxicol. Pharmacol. 25*:1–5.

B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
hPa	hectopascal
IChEMS	Industrial Chemicals Environmental Management Standard
IMAP	Inventory Multitiered Assessment and Prioritisation
IUPAC	International Union of Pure and Applied Chemistry
kg/m^3	kilograms per cubic metre
kPa	kilopascal
LC	lethal concentration
mg/L	milligrams per litre
mPa s	millipascal second

NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NOEC	no observed effective concentration
OECD	Organisation for Economic Co-operation and Development
Pa	Pascal
PBT	Persistent, Bioaccumulative and Toxic
PEG	polyethylene glycol
PPG	polypropylene glycol
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases

POLYVINYL ALCOHOL

This dossier on polyvinyl alcohol presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. It does not represent an exhaustive or critical review of all available data. Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion: Polyvinyl alcohol is a polymer of low concern. Therefore, it is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

Polyvinyl alcohol is a water-soluble, non-ionic synthetic polymer obtained by polymerisation of vinyl alcohol, which typically affords high molecular weight polymers with stable saturated carbon-chain backbones.

Polyvinyl alcohol is recognized as one of the very few vinyl polymers soluble in water and also susceptible of ultimate biodegradation in the presence of suitably acclimated microorganisms. The substance is not expected to bioaccumulate or bioconcentrate. It is of low toxicity to environmental receptors.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): poly(1-hydroxyethylene)

CAS RN: 9002-89-5

Molecular formula: $(C_2H_4O)_x$ [This substance is a polymer.]

Molecular weight: 44.05 g/mol (monomer); 120,000 g/mol (NAMW, polymer)

Synonyms: Ethenol, homopolymer; vinyl alcohol, polymers; polyvinyl alcohol

3 PHYSICO-CHEMICAL PROPERTIES

Polyvinyl alcohol is produced commercially from polyvinyl acetate, usually by a continuous process. The acetate groups are hydrolysed by ester interchange with methanol in the presence of anhydrous sodium methylate or aqueous sodium hydroxide. The physical characteristics and its specific functional uses depend on the degree of polymerisation and the degree of hydrolysis (FAO, 2004).

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of Polyether Amine

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	odorless white to cream-colored granules or powder	-	NCBI, 2026
Melting Point	>200 °C @ 101.3 kPa, Decomposes at 228 °C	-	NCBI, 2026
Boiling Point	340 °C @ 101.3 kPa	-	NCBI, 2026
Density	1,329 kg/m^3 @ 25°C	-	NCBI, 2026
Vapor Pressure	Negligible	-	NCBI, 2026
Partition Coefficient (log K_{ow})	Not relevant for high molecular weight polymer	-	NCBI, 2026
Water Solubility	Soluble	-	NCBI, 2026
Dissociation constant (pKa)	Not relevant	-	NCBI, 2026
Viscosity	Not relevant, substance is a solid	-	NCBI, 2026

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 1). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for polyvinyl alcohol.

NICNAS has assessed polyvinyl alcohol in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it is a polymer of low concern for human health and poses no unreasonable risk to the environment.[1][2]

Table 1 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

Limited experimental data are available for polyvinyl alcohol.

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=4953433e-f36b-1410-8924-008e64e216c7
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=4c6d433e-f36b-1410-8de4-00e8f2afc108

Polymers with a molecular weight greater than 1,000 g/mol generally have a negligible vapor pressure, which indicates that the chemical is likely to exist solely as particulate matter in the atmosphere. As particulate matter, atmospheric oxidation is not expected to be a significant route of environmental removal. Likewise, volatilisation from water or moist soil is not expected to occur at an appreciable rate (USEPA, 2013).

Polyvinyl alcohol is recognized as one of the very few vinyl polymers soluble in water and also susceptible of ultimate biodegradation in the presence of suitably acclimated microorganisms. Polyvinyl alcohol is one of few vinyl polymers that can have a higher biodegradation rate owing to the presence of hydroxyl groups which condition hydrophilic nature of this material. A Zahn-Wellens test using polyvinyl alcohol at 500 mg/L and a non-adapted activated sludge inoculum found 20, 50 and 90% degradation after 17, 24 and 28 days respectively; using an adapted activated sludge, 20, 50 and 90% degradation occurred after 0.5, 2 and 6 days respectively. The natural degradation of polyvinyl alcohol in water or soil occurs readily at 100% degradation in 30 days or less (NCBI, 2026).

A bioconcentration factor of <7.5 was measured using carp (*Cyprinus carpio*) which were exposed over a 6-week period to 0.4 and 4.0 ppm polyvinyl alcohol (NCBI, 2026). Based on this reported value, the potential for bioaccumulation is low. This is consistent with the high molecular weight of the polymer is expected to preclude or minimize bioaccumulation. Polymers with a number average molecular weight (NAMW) greater than 1,000 g/mol cannot cross biological membranes (Boethling and Nabholz 1997).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Aquatic Toxicity

Limited ecotoxicity data was identified for polyvinyl alcohol. In literature, studies on read-across polyvinyl alcohol (CAS RN 25213-24-5) reported a 72-hr ErC_{50} and 96-hr ErC_{50} of >1,000 mg/L in *Raphidocelis subcapitata*; EC_{50} (24hr and 48 hr) > 1,000 mg/L in *Daphnia magna*; and, LC_{50} > 1,000 mg/L in *Danio rerio* conducted in a fish embryo toxicity assay (McDonough et al, 2024).

Additional information on Non-Ionic Polymers Group (DoEE, 2017) is provided below.

> *"Water soluble or dispersible non-ionic polymers, such as polyacrylamide, are also typically of low concern for ecotoxicity. Non-ionic polymers with NAMW greater than 1 000 cannot be absorbed across biological membranes in aquatic organisms, and therefore toxicity only occurs through indirect effects such as chelation of essential nutrients (Beothling and Nabholz 1997). However, the structure of polyacrylamide suggests that it will have low potential to act by this mode of action. This is further supported by median effective concentration (EC50) and median lethal concentration (LC50) values available for other water soluble or dispersible non-ionic polymers, which are greater than 100 mg/L (Beothling and Nabholz 1997).*
>
> *Water soluble or dispersible polymers with NAMW less than 1 000 Da, or significant levels of LMW substances and trapped monomers, are of potential concern because of their increased bioavailability. However, this assessment was conducted assuming that the polymers in this group have NAMW greater than 1 000 Da and the percentage of LMW species is low."*

B. Terrestrial Toxicity

No data are available.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Polyvinyl alcohol is readily biodegradable. Thus, it does not meet the criteria for persistence.

Polyvinyl alcohol is not expected to bioaccumulate. Polymers with a NAMW greater than 1,000 g/mol cannot cross biological membranes (Boethling and Nabholz 1997). Thus, it does not meet the screening criteria for bioaccumulation.

Limited aquatic toxicity studies are available for polyvinyl alcohol. It is expected to be a low concern of toxicity to aquatic organisms because of its low potential for bioavailability. Thus, it does not meet the screening criteria for toxicity.

The overall conclusion is that polyvinyl alcohol is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for polyvinyl alcohol.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Polyvinyl alcohol	9002-89-5	Not a PBT	No	Yes	No	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy
ECHA	European Chemicals Agency
EU	European Union
IChEMS	Industrial Chemicals Environmental Management Standard
IMAP	Inventory Multitiered Assessment and Prioritisation
IUPAC	International Union of Pure and Applied Chemistry
NAMW	number average molecular weight
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency
UVCB	Unknown or Variable Composition, Complex Reaction Products and Biological Materials

QUATERNARY AMMONIUM COMPOUNDS, BIS (HYDROGENATED TALLOW ALKYL), DIMETHYL, SALTS WITH BENTONITE (CAS RN 68953-58-2)
QUATERNARY AMMONIUM COMPOUNDS, BIS(HYDROGENATED TALLOW ALKYL)DIMETHYL, SALTS WITH ATTAPULGITE (CAS RN 68953-57-1)

This dossier is for quaternary ammonium compounds, bis (hydrogenated tallow alkyl), dimethyl, salts with bentonite (CAS RN 68953-58-2) and quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with attapulgite (CAS RN 68953-57-1). For the purposes of this dossier, this quaternary ammonium compounds, bis (hydrogenated tallow alkyl), dimethyl, salts with bentonite will be referred to as dialkyl chain quaternary ammonium compound [2M(2Alk)] bentonite. Limited information is available for quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with attapulgite (CAS RN 68953-57-1). Therefore, information provided in this dossier is based on 2M(2Alk) bentonite.

This dossier presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the OECD-SIDS Initial Assessment Profile on the Organoclays Category (OECD, 2007). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): quaternary ammonium compounds, bis (hydrogenated tallow alkyl), dimethyl, salts with bentonite

CAS RN: 68953-58-2

Molecular formula: Unspecified

Molecular weight: Unspecified. Substance is a UVCB.

Synonyms: Quaternium-18 Bentonite; dialkyl chain quaternary ammonium compound [2M(2Alk)] bentonite; bis (hydrogenated tallow alkyl) dimethylammonium bentonite

SMILES: Not applicable. Substance is a UVCB.

Chemical Name (IUPAC): quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, chlorides, compounds with attapulgite

CAS RN: 68953-57-1

Molecular formula: Unspecified

Molecular weight: Unspecified. Substance is a UVCB.

Synonyms: Bis(hydrogenated tallow alkyl)dimethylammonium attapulgite

SMILES: Not applicable. Substance is a UVCB.

II. PHYSICO-CHEMICAL PROPERTIES

2M(2Alk) bentonite is one of a group of organoclays composed of quaternary ammonium compounds (cations) that have the following general formula:

N+R1, R2, R3, R4

Where R1, R2, R3, and R4 are substitutions on the N (nitrogen atom) of the quaternary compound (salt) as follows:

- Methyl – 1 or 2 substitutions
- Benzyl – 0 or 1 substitutions
- Alkyl (C14-22) – 1, 2 or 3 substitutions

The organoclays discussed in this dossier are hydrogenated tallowalkonium bentonites and are the product of the reaction of hydrogenated tallowalkonium chloride and bentonite. Bentonite is a widely distributed natural material consisting predominantly of the clay montmorillonite, a smectite clay. Bentonite is formed of highly colloidal and plastic clays and is produced by in-situ devitrification of volcanic ash (CIR, 2016).

Organoclays, such as 2M(2Alk) bentonite, are free flowing solid powders that are essentially insoluble in water, in organic solvents and in lipids. They are not volatile under ambient conditions. The organoclays do not melt or boil, although some degradation may occur when subjected to extreme heat at about 180^0C to 600^oC. The densities range from 1,400 to 1,800 kg/m^3 (temperature not provided) (OECD, 2007).

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

The clay component of 2M(2Alk) bentonite is not biodegradable, and the organic component is not readily biodegradable. Bioaccumulation is not expected due to the insolubile nature of 2M(2Alk) bentonite. Quaternary ammonium ions are tightly held to the clay, resulting in organoclay compounds (“salts”) that are very hydrophobic in nature (OECD, 2007).

B. Biodegradation

No biodegradation studies were located for 2M(2Alk) bentonite. Biodegradation studies are available for quaternary ammonium compounds, benzylbis (hydrogenated tallow alkyl)methyl, chlorides, compounds with bentonite [also referred to as B(2Alk)M bentonite].

In three separate OECD TG 306 biodegradation tests using B(2Alk)M bentonite, biodegradation ranged from 4.7 to 33.4% in 28 days (OECD, 2007). Based on these data as well as the structural and chemical properties of these compounds, it is assumed that other organoclay category members will also show limited biodegradation. It should be noted that biodegradation relates only to the organic component of the organoclays (i.e., the alkyl quaternary ammonium salts).

If a chemical is found to be not readily or inherently biodegradable, it is categorised as Not Persistent since its half-life is substantially greater than 60 days (DoEE, 2017).

C. Environmental Distribution

Quaternary ammonium ions are tightly held to the clay, resulting in organoclay compounds ("salts") that are very hydrophobic in nature (OECD, 2007).

D. Bioaccumulation

Bioaccumulation is not expected due to the insolubility of 2M(2Alk) bentonite (OECD, 2007).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

2M(2Alk) bentonite has low acute toxicity and is excreted rapidly. This substance is not irritating nor is it a skin sensitiser.

No systemic effects were observed in repeat dose oral or dermal toxicity studies. It is not genotoxic, carcinogenic, nor is it a reproductive or developmental toxicant.

B. Metabolism

2M(2Alk) bentonite are not expected to be absorbed following oral (gavage) and it will be excreted rapidly via faeces with negligible elimination from the urine and bile. There is no evidence of any tissue retention or systemic uptake of this substance. This substance is not expected to be respirable based on the particle size nor is it is expected to be absorbed through the skin.

C. Acute Toxicity

Acute toxicity studies demonstrate a low order of toxicity with an inhalation 4-hr LC_{50}S and an oral gavage LD_{50}S greater than 5.0 milligrams per litre (mg/L) and 5,000 milligrams per kilogram body weight (mg/kg/bw) respectively.

The oral LD_{50} for 2M(2Alk) bentonite is >8,000 mg/kg in rats (CIR, 1982) [Kl. score = 4]. The inhalation LC_{50} for 2M(2Alk) bentonite is >5.7 mg/L in rats for a 4-hr. 22-min. exposure. There were no mortalities, and the particle size was $\geq$ 10 micrometre (μm), 30% $\leq$ μm (CIR, 2016) [Kl. score = 4].

No acute dermal toxicity studies are available.

D. Irritation

2M(2Alk) bentonite is not irritating to the skin. Eye irritation is generally minimal in human and moderate in animals.

Application of 0.5 g. 2M(2Alk) bentonite to the skin of rabbits for 6 hours/day for five consecutive days, followed by 10 days of rest and then five more days of exposure, did not result in any signs of irritation (CIR, 1982) [Kl. score = 4].

Instillation of 0.1 mL of a 10% suspension of 2M(2Alk) bentonite in physiological saline produced no signs of irritation (CIR, 1982) [Kl. score = 4].

E. Sensitisation

2M(2Alk) bentonite was not considered a skin sensitiser when tested in a guinea pig sensitisation test (CIR, 1982) [Kl. score = 4].

F. Repeated Dose Toxicity

Oral

Rats were fed diets containing 0, 1%, 5%, or 25% 2M(2Alk) bentonite for 12 weeks. There was a depression of growth rate at the 25% test substance dose level, being somewhat more marked in males. There were no treatment-related effects seen in the hematology parameters, organ weights, gross pathology, or histopathology. Assuming 1% in the diet translated to about 500-1,000 mg/kg-bw/day, the no observed adverse effect level (NOAEL) (25% in the diet) was determined to be approximately 12,500 to 25,000 mg/kg-bw/day, the highest dose tested (OECD, 2007). [Kl. Score = 4].

Inhalation

No studies available.

Dermal

Rabbits were administered to the skin under occlusive conditions 0.5 g 2M(2Alk) bentonite for 6 hours/day for 90 days. There was no evidence of local or systemic toxicity (CIR, 1982) [Kl. score = 4].

G. Genotoxicity

In vitro Studies

The *in vitro* genotoxicity studies on 2M(2Alk) bentonite are presented in Table 1.

Table 1: *In vitro* Genotoxicity Studies on 2M(2Alk) bentonite

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Mouse lymphoma cells	-	-	-	OECD SIDS 2007
Bacterial reverse mutation assay	-	-	-	OECD SIDS 2007

*+, positive; -, negative

In vivo Studies

No studies are available for 2M(2Alk) bentonite. However, this substance is not expected to be mutagenic based on read across to B(Alk)2M bentonite (OECD, 2007).

H. Carcinogenicity

There are no data regarding the carcinogenicity of 2M(2Alk) bentonite. However, the impurity, respirable crystalline silica which may be present at 0.1-5% is considered a known human carcinogen (Group 1 according to IARC) (OECD, 2007).

I. Reproductive Toxicity

2M(2Alk) bentonite is not expected to be a reproductive toxicant based on results from a one-generation reproduction study using another organoclay substance [B(2Alk)M hectorite] at dose levels of 0, 50, 225, and 1,000 mg/kg bw/day in rats. There were no treatment-related effects on adults or litters at any dose level. The parental and F1 offspring NOAEL was 1,000 mg/kg bw/d, the highest dose tested (OECD, 2007).

J. Developmental Toxicity

2M(2Alk) bentonite is not expected to be a developmental toxicant based on results from a one-generation reproduction/developmental toxicity study using another organoclay substance [B(2Alk)M hectorite] at dose levels of 0, 50, 225, and 1,000 mg/kg bw/day in rats. There were no treatment-related effects on litters at any dose level. The only statistically significant effect was a reduction in group mean litter weight from day 7 to 21 of lactation caused by a slightly reduced group mean litter size at 1,000 mg/kg bw/d. This effect was not considered to be of toxicological significance. There were no effects on mean individual offspring weights. There were no toxicologically significant findings for all parameters evaluated; the NOAEL was 1,000 mg/kg bw/d, the highest dose tested (OECD, 2007).

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKIN WATER GUIDANCE VALUES

The toxicological reference values developed for 2M(2Alk) bentonite follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

2M(2Alk) bentonite has been tested in a rat 12-week dietary study. The NOAEL was 12,500 mg/kg bw/day, the highest dose tested. This NOAEL will be used for determining the oral reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

- UF_A (interspecies variability) = 10
- UF_H (intraspecies variability) = 10
- UF_L (LOAEL to NOAEL) = 1
- UF_{Sub} (subchronic to chronic) = 3
- UF_D (database uncertainty) = 1
- Oral RfD = 12500/(10 x 10 x 1 x 3 x 10) = 12500/300 = 41.67 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (41.67 x 70 x 0.1)/2 = 146 mg/L

B. Cancer

There are no carcinogenicity studies on 2M(2Alk) bentonite. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

2M(2Alk) bentonite does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

2M(2Alk) bentonite has low acute toxicity to fish and invertebrates, with likely low acute toxicity to algae. A chronic Daphnia study conducted on an organoclay similar to B(Alk)2M bentonite suggests that these compounds may have moderate chronic toxicity concerns for aquatic organisms. However, the toxicity observed in the study has been due, in part, to the physical effects of the organoclay test material. B(Alk)2M bentonite is virtually non-toxic to terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 2 lists the results of acute aquatic toxicity studies conducted on 2M(2Alk) bentonite.

Table 2: Acute Aquatic Toxicity Studies on 2M(2Alk) bentonite

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Freshwater rainbow trout	96-hour LC_{50}	>ca. 500**	4	OECD SIDS, 2007
Daphnia magna	48-hour EC_{50}	>100	4	OECD SIDS, 2007
Daphnia magna	96-hour EC_{50}	300 **	4	OECD SIDS, 2007
Daphnia magna	48-hour EC_{50}	<500**	4	OECD SIDS, 2007
Skeletonema costatum	72-hour EC_{50}	23.8** (growth rate)	4	OECD SIDS, 2007
Skeletonema costatum	72-hour EC_{50}	82.3 (growth rate)	4	OECD SIDS, 2007
Skeletonema costatum	72-hour EC_{50}	>1,000** (growth rate)	4	OECD SIDS, 2007

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Scenedesmus subspicatus	72-hour EC_{50}	>100 (growth rate)***	4	OECD SIDS, 2007

*Only one concentration was used
** Test material was B(2Alk)M bentonite (CAS No. 68153-30-0)
*** Test material was B(2Alk)M hectorite (CAS RN 121888-67-3).

Chronic Studies

No chronic studies are available on 2M(2Alk) bentonite. The 21-day no observed effect concentration (NOEC) in a *Daphnia* reproduction test on B(2Alk)M hectorite was 3.2 mg/L (OECD, 2007). The mortality of *Daphnia* seen at the LOEC of 32 mg/L was considered to be due, in part, to physical effects of the test material.

The 72-hour NOEC in a *Scenedesmus subspicatus* OECD TG201 toxicity test on B(2Alk)M hectorite was 100 mg/L, based on growth rate (OECD, 2007).

C. Terrestrial Toxicity

The 14-day NOEC of another organoclay substance [B(Alk)2M bentonite] to earthworms is 1,000 mg/kg. Since 1,000 mg/kg is the limit dose, it is assumed that the LC_{50} is >1,000 mg/kg (OECD, 2007).

Terrestrial plant toxicity are available for B(2Alk)M hectorite (CAS No. 12188-67-3). The EC_{50} values of B(2Alk)M hectorite for the emergence and early growth stages of wheat and radish seedlings (*Tritium aestivum* and *Raphanus sativus*, respectively) are >100 mg/kg; the NOEC are 100 mg/kg, the highest dose tested (OECD, 2007). The LC_{50} of B(2Alk)M hectorite was 9 mg/kg for the emergence and early growth stages of cress seedling (*Lepidum sativum*); the LOEC was 1 mg/kg, and a NOEC was not established (OECD, 2007).

D. Calculation of PNEC

The PNEC calculations for 2M(2Alk) bentonite follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute $E(L)C_{50}$ values are available for fish (500 mg/L), invertebrates (100 mg/L), and algae (100 mg/L). Chronic NOEC values are available for invertebrates (3.2 mg/L) and algae (100 mg/L). On the basis that the data consists of short-term results from three trophic levels and long-term results from two trophic levels, an assessment factor of 50 has been applied to the lowest reported $E(L)C_{50}$ value of 3.2 mg/L for invertebrates (daphnia). The $PNEC_{aquatic}$ is 0.064 mg/L.

PNEC Sediment

No experimental toxicity data on sediment organisms are available. The K_{ow} of 2M(2Alk) bentonite cannot be calculated because it is essentially insoluble in water. Thus, the equilibrium partition method cannot be used to determine a $PNEC_{sediment}$.

PNEC Soil

No experimental toxicity data on terrestrial or soil organisms are available for 2M(2Alk) bentonite. Experimental results are available for two trophic levels for other organoclay substances in the group. An acute LC_{50} value is available for earthworms (>1,000 mg/kg). Results from the long-term studies are only available for terrestrial plants, which give widely divergent results. On the basis that the data consist of one short-term result from one trophic level, an assessment factor of 1,000 has been applied to the acute LC_{50} value of 1,000 mg/kg for earthworms. The $PNEC_{soil}$ is 1.0 mg/kg soil dry weight.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

The clay component of 2M(2Alk) bentonite is not biodegradable, and the organic component is not readily biodegradable. Thus, the substance meets the screening criteria for persistence.

2M(2Alk) bentonite is insoluble in water and is not bioavailable. Thus, it is not expected to meet the screening criteria for bioaccumulation.

There are no chronic aquatic toxicity studies available on 2M(2Alk) bentonite; however, the lowest chronic NOEC for a chronic Daphnia study on a similar organoclay is >0.1 mg/L. The acute E(L)C50 values for 2M(2Alk) bentonite and similar organoclays are >1 mg/L in fish, invertebrates and algae. Thus, 2M(2Alk) bentonite does not meet the screening criteria for toxicity.

The overall conclusion is that 2M(2Alk) bentonite is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Not Classified

B. Labelling

None

C. Pictogram

None

X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

Workplace Australia has not established a value for this substance.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

2M(2Alk) bentonite is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGEMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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QUATERNARY AMMONIUM COMPOUNDS, DI-C16-18-ALKYLDIMETHYL, CHLORIDES

This dossier on quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): dimethyl-di(tetratriacontan-16-yl)azanium chloride

CAS RN: 92129-33-4

Molecular formula: $C_{70}H_{144}ClN$

Molecular weight: 1035.3 g/mol

Synonyms: Quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides, Ammonium halides, di-C16-18-alkyldimethylammonium chlorides, Tetraalkylammonium compounds, di-C16-18-alkyldimethylammonium chlorides

SMILES:
CCCCCCCCCCCCCCCCCC(CCCCCCCCCCCCCCC)[N+](C)(C)C(CCCCCCCCCCCCCCC)CCCCCCCCCCCCCCCCCC.[Cl-]

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of Quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Crystallized white-yellow solid	2	ECHA
Melting Point	62.1°C @ 101.3 kPa	2	ECHA
Boiling Point	627.53°C @ 101.3 kPa	2	ECHA
Density	903 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	0 Pa @ 25°C	2	ECHA
Partition Coefficient (log K_{ow})	8.4 @ 25°C	2	ECHA
Water Solubility	0.038 g/L @ 23°C	2	ECHA
Flash Point	Not available	-	-
Auto flammability	396°C	2	ECHA

Property	Value	Klimisch Score	Reference
Viscosity	Not applicable. Substance is a solid.	-	ECHA
Henry's Law Constant	Not available	-	-

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides is not readily biodegradable. It has low potential for bioaccumulation. It may adsorb to some minerals on soil and sediment, but not other minerals.

B. Biodegradation

Quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides is not readily biodegradable. In an activated sludge study under aerobic conditions, there was 3% degradation after 28 days and 68% degradation after 287 days based on oxygen consumption, which does not meet OECD guidelines for biodegradability (ECHA) [KI. Score = 1].

C. Environmental Distribution

Quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides is expected to adsorb to some minerals in soil and sediment, but not others. The log K_{oc} is a poor predictor of the partitioning behaviour of cationic surfactants in the environment and ionic interactions play a more important role than hydrophobic partitioning with organic matter (ECHA).

D. Bioaccumulation

Based on a BCF of 13 L/kg, quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides has low potential for bioaccumulation. A 49-day study with *Lepomis macrochirus* (bluegill fish) in river water identified a BCF range of 13 L/kg in whole body and 94 L/kg in viscera. When laboratory water was used, the BCFs were 32 and 256 L/kg, respectively (ECHA).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride is noted to be a low hazard from acute/short term exposures. It is an irritant to the eyes, but it is not irritating to the skin and it is not a skin sensitiser. Based on the data available, the chemical may have some effects from repeated exposures to high concentrations. The substance is not genotoxic and is not reported to be mutagenic or carcinogenic. At high doses in animal studies, this compound may have adverse effects on reproduction (decreases in live births and viability) but is not reported to be a development toxicant or teratogen.

B. Metabolism

There are no data that describe the toxicokinetics or metabolism of quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride via oral or inhalation routes of exposure. An *in vivo* study was conducted on rabbits (unspecified strain/sex) dermally exposed to 10 milligrams (mg) of

radiolabelled quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride for 72 hours (hrs) to determine absorption rates and excretion routes (via urine, faeces, or expired air). Only traces of radioactivity were detected in the excreta evaluated, indicating that dermal absorption of this compound is very low (<1%).

C. Acute Toxicity

Oral

An OECD Guideline 401 (Acute Oral Toxicity) test was conducted on quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride. In this study, male and female Sprague-Dawley rats were orally gavaged with a dose of 5000 mg per kilogram body weight (mg/kg-bw) of the compound in methylcellulose and observed for 14 days. Transient clinical effects (e.g., piloerection, hunched posture, pallor of extremities and/or abnormal gait) were observed but resolved by day four of the observation period. No mortality was recorded and autopsy findings were normal. Based on this study, an oral LD50 of >5000 mg/kg-bw is identified for quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride (ECHA). [Kl. Score = 1]

Inhalation

In a study of male albino rats, aerosolized quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride at a concentration of 180 mg per litre of air (mg/L) was introduced to a test chamber for one hour. Animals were observed during exposure and for 14 days following. No mortality or abnormalities during gross pathology were observed during the study, outside of clinical behaviour (excitement, salivation, lacrimation) during exposure in the test chamber. Based on this study, a LC50 of >180 mg/L (180,000 mg/m^3) is identified for this compound (ECHA). [Kl. Score = 2]

Dermal

An OECD Guideline 402 (Acute Dermal Toxicity) test was conducted on male and female Sprague-Dawley rats. Five animals per sex were exposed for 24 hrs to an aqueous solution of quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride at a dose of 2000 mg/kg-bw and observed periodically for 14 days post exposure for mortality and other clinical signs of toxicity (organ weights, histopathology). Aside from some dryness of the skin, no systemic effects, including mortality, or localized irritation were observed. Based on this study, a dermal LD50 of >2000 mg/kg-bw is identified for this compound (ECHA). [Kl. Score = 1]

D. Irritation

Skin

Two OECD Guideline 404 (Acute Dermal Irritation) tests have been conducted on New Zealand White rabbits for two technical grades of quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride, the first being a 97% pure technical grade composition and the other a composition of 77% in isopropanol/water. In the 97% pure composition, 0.5 g of material was pasted onto skin via saline for 4 hrs and observed for up to 14 days. While oedema results were negative, mild evidence of erythema (as dry discoloured skin with scales) were observed but resolved within the 14-day observation period.

For the 77% composition, 0.5 mL was administered to the skin for 4 hrs and observed periodically for 14 days following exposure. After 72 hrs, moderate erythema and oedema were observed which

proceeded to severe erythema after 7 days with some partially observed after 14 days and some scarring observed in two animals.

Based on these two studies, quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride is not classified as irritating to the skin, but the technical grade should be classified as Category 1C (corrosive) (ECHA). [Kl. Score = 1]

Eye

In an OECD Guideline 405 (Acute Eye Irritation/Corrosion), 0.1 mL of quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride (as 77% technical grade composition in isopropanol/water) was applied to the eye of one male White New Zealand rabbit and clinical findings recorded at 1 and 24 hrs after exposure. Due to the severity of chemosis and ocular lesions observed at 24 hours, the animal was sacrificed for ethical reasons. Based on this study, quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride is identified as highly irritating to eyes (ECHA). [Kl. Score = 1]

E. Sensitisation

Animal Studies

An OECD Guideline 406 (Skin Sensitisation) was conducted on male Dunkin-Hartley guinea pigs using a technical grade composition of 78% quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride in isopropanol/water. During the induction phase of the study, intradermal and cutaneous administration of the compound was conducted on day 1 and day 8, respectively. On day 22, cutaneous application of a 2.5% and a 1% in distilled water was applied to test for sensitisation. In a small subset of animals, slight irritation/erythema was observed, but were considered more consistent with irritation than delayed contact sensitivity (ECHA). [Kl. Score = 2]

Human Studies

A repeat patch insult test in human volunteers was completed in 73 subjects. In the initial insult phase, skin patches were administered with a 2% solution in distilled water to the upper arms, three times a week for three weeks. Fourteen days after the final insult patch, a challenge patch was applied to each arm and sensitization scores were recorded at 48 and 96 hrs after patch removal. Although some irritation was observed during the insult phase, no reactions were recorded during the challenge phase (ECHA). [Kl. Score = 2]

Based on this study, quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride is not considered a skin sensitiser to humans.

F. Repeated Dose Toxicity

An OECD guideline 407 study (Repeated Dose 28-Day Oral Toxicity Study in Rodents) was conducted for male and female Wistar rats exposed to 90% quaternary ammonium compounds, di-C16-18-alkyldimethyl in water. The animals were orally gavaged with the compound in sesame oil at doses of 20, 100 and 500 mg/kg-bw/day for 28 days. During the exposure period, test animals showed some clinical signs of toxicity, including abnormal gait, laboured breathing, and distended abdomens. In addition, animals in the high dose group had increased in organ weights for the adrenal gland as well as observed focal necrosis of the adrenal cortex in two females. No substance-induced changes were detected in the 20 or 100 mg/kg-bw dose groups. Based on this study, a

NOAEL of 100 mg/kg-bw was identified for quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride (ECHA). [Kl. Score = 2]

There were no inhalation or dermal toxicity studies available for quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride.

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay) (*Salmonella typhimurium TA1535, TA1537, TA98, TA100*)	-	-	2	ECHA
OECD Guideline 473 (*In vitro* Mammalian Chromosome Aberration Test) (Chinese hamster lung fibroblasts (V79))	-	-	1	ECHA
OECD Guideline 476/EU Method B.17 (*In vitro* Mammalian Cell Gene Mutation Test) (mouse lymphoma L5178Y cells)	-	-	1	ECHA

*+, positive; -, negative

Based on the in vitro results, quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride is not classified as genotoxic.

No *in vivo* studies are available.

H. Carcinogenicity

No carcinogenicity studies are available for quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride. Limited genotoxic and mutagenic tests do not indicate this compound is likely a carcinogen (ECHA).

I. Reproductive Toxicity

An OECD Guideline 421 (Reproduction/Developmental Toxicity Screening) test was conducted on male and female Crj:CD(SD) rats orally gavaged with 96.8% quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride in corn oil at doses of 62.5, 125 and 500 mg/kg-bw/day. Animals were treated for two weeks prior to mating and continued until day 28 for males and up to day 3 of lactation prior to sacrifice of adults and pups. At 500 mg/kg-bw/day, clinical effects including mortality, weight loss, and dyspnoea were observed in the parental generation. In addition, female rabbits in this high dose group had a statistically significant increase in implantation losses and lower rates of live births and viability indices at postnatal day 4.

Based on this study, a NOAEL of 125 mg/kg-bw/day for reproductive toxicity is identified for this compound (ECHA). [Kl. Score = 1]

J. Developmental Toxicity

No development studies are available for quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride directly, however, an OECD Guideline 414 (Prenatal Developmental Toxicity) test was conducted for a structurally similar compound, ditallowdimethylammonium chloride (DTDMAC; CAS 107-64-2). In this read across study, 25 time-mated Sprague-Dawley rats were orally gavaged with 100 and 500 mg/kg-bw/day of DTDMAC or provided a diet with a dose of 0.65% of the compound both beginning on day 6 of gestation. No maternal or foetal effects with regard to pregnancy or mortality were observed in any of the test groups.

Based on this study, a NOAEL of 500 mg/kg-bw is identified for development effects of DTDMAC, and by read across quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride (ECHA). [Kl. Score = 2]

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

A subchronic oral gavage study of quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride in rats identified a NOAEL of 100 mg/kg-bw. The NOAEL from this study is based on no effect for clinical toxicity and adrenal gland effects. This NOAEL will be used to derive an oral reference dose and drinking water guideline value this compound.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

- UF_A (interspecies variability) = 10
- UF_H (intraspecies variability) = 10
- UF_L (LOAEL to NOAEL) = 1
- UF_{Sub} (subchronic to chronic) = 10
- UF_D (database uncertainty) = 1
- Oral RfD = 100/(10 x 10 x 1 x 10 x 1) = 100/1000 = 0.1 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.1 x 70 x 0.1)/2 = 0.35 mg/L

B. Cancer

No studies were available for the carcinogenicity of quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride. Thus, a cancer reference value for the substance was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Quaternary ammonium compounds, di-C16-18-alkyldimethyl, chloride does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Quaternary ammonium compounds are of moderate toxicity concern to fish and invertebrates; they are highly toxic to aquatic plants. It is a low toxicity concern for terrestrial organisms.

B. Aquatic Toxicity

Quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides are poorly soluble in water and also have a strong tendency to adsorb to negatively charged surfaces such as suspended matter, vessels or organic material (including dissolved organic matter such as humic acids). Many cationic substances in general but long chain dialkyl quats in particular rank among the most difficult substances to test in environmental toxicology. Standard guideline studies are inappropriate to test substances with such properties and the current REACH Guidance Documents do not provide sufficient guidance concerning bioavailability and exposure assessment for cationic surface-active substances like the dialkylquats as these were written with normal hydrophobic chemicals in mind, failing to take into account the lack of bioavailability that occurs in the environment with these substances. Aquatic ecotoxicity tests performed in river water are therefore considered to assess the aquatic environmental risk more realistically for these difficult substances as the use of river water in the effect assessment compensates for the deficient prediction of the bioavailability in the exposure assessment. Aquatic ecotoxicity tests performed in river water are therefore considered as higher tier tests when compared to aquatic ecotoxicity tests performed in reconstituted lab water (ECHA).

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides.

Table 3: Acute Aquatic Toxicity Studies on Quaternary Ammonium Compounds, di-C16-18-Alkyldimethyl, Chlorides

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Pimephales promelas (Fathead minnow)	96-hr LC_{50}	21.3	2	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	3.1	2	ECHA
Raphidocelis subcapitata (Green algae)	72-hr EC_{50}	0.48 (growth)	2	ECHA

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides.

Table 4: Chronic Aquatic Toxicity Studies on Quaternary Ammonium Compounds, di-C16-18-Alkyldimethyl, Chlorides

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Pimephales promelas (Fathead minnow fish)	35-day NOEC	0.23	1	ECHA
Daphnia magna (Water flea)	21-day NOEC	0.38	1	ECHA
Raphidocelis subcapitata (Green algae)	5-day NOEC	0.062 (growth)	2	ECHA

C. Terrestrial Toxicity

A 21-day study under OECD Guideline 208 for seedling emergence and growth assessed plants (*Phaseolus aureus* [mung bean], *Helianthus annuus* [sunflower], and *Sorghum bicolor* [great millet]) in artificial soil containing compost with 80% sand/gravel and 20% silt/clay. NOEC values of >10,000 mg/kg dw for mung bean and >1,000 mg/kg dw for sunflower and great millet were identified based on growth (ECHA) [KI. Score = 2].

D. Calculation of PNEC

The PNEC calculations for quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute $E(L)C_{50}$ values are available for fish (21.3 mg/L), invertebrates (3.1 mg/L), and algae (0.48 mg/L). NOEC values from long-term studies are available for fish (0.23 mg/L), invertebrates (0.38 mg/L) and algae (0.062 mg/L). On the basis that the data consists of short-term and long-term results from three trophic levels, an assessment factor of 10 has been applied to the lowest reported NOEC value of 0.062 mg/L for algae. The $PNEC_{water}$ is 0.0062 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. The log K_{oc} is a poor predictor of the partitioning behaviour of cationic surfactants in the environment and ionic interactions play a more important role than hydrophobic partitioning with organic matter Thus, the equilibrium partition method cannot be used to determine a $PNEC_{sediment}$.

PNEC Soil

There is limited toxicity data for terrestrial or soil organisms. The log K_{oc} is a poor predictor of the partitioning behaviour of cationic surfactants in the environment and ionic interactions play a more important role than hydrophobic partitioning with organic matter Thus, the equilibrium partition method cannot be used to determine a $PNEC_{soil}$.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides are not readily biodegradable and thus does meet the screening criteria for persistence.

The measured BCF in fish range between 32 L/Kg and 256 L/Kg. Thus, quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides does not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides are > 0.1 mg/L in fish and invertebrates and <0.1 mg/L in algae. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies are > 1 mg/L in fish and invertebrates and <1 mg/L in algae. Thus, quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides does meet the criteria for toxicity.

The overall conclusion is that quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Eye Dam. Category 1, H318

Aquatic Acute Category 1, H400

Aquatic Chronic Category 1, H410

B. Labelling

Danger

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

The workplace exposure standards for Quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides in Australia is not available.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Quaternary ammonium compounds, di-C16-18-alkyldimethyl, chlorides are not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Not listed.

XIII. REFERENCES

Australian Drinking Water Guidelines [ADWG]. (2011). National Water Quality Management Strategy. Australian Drinking Water Guidelines, Section 6, Australian Government, National Health and Medical Research Council, Natural Resource Management Ministerial Council. Updated June 2025. https://www.nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines

Department of the Environment, Water, Heritage and the Arts [DEWHA]. (2009). Environmental risk assessment guidance manual for industrial chemicals, Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia. Available: http://www.nepc.gov.au/resource/chemical-risk-assessment-guidance-manuals

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Klimisch, H.J., Andreae, M., and Tillmann, U. (1997). A systematic approach for evaluating the quality of experimental and toxicological and ecotoxicological data. Regul. Toxicol. Pharmacol. 25:1-5.

RAPE OIL

This dossier on Rape Oil presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – <insert chemical name> is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

Rape oil is a plant oil extracted from rapeseed (*Brassica napus*). It is a triglyceride based substance whose identity is defined by its fatty acid profile comprising 98-99% of its composition. Modern food grade and industrial rapeseed oils are dominated by monounsaturated oleic acid, with smaller but functionally important amounts of polyunsaturated linoleic and alpha linolenic acids, plus a low level of saturated fats.

Rape oil is readily biodegradable. It is not expected to bioaccumulate. It would be expected to be essentially immobile in soil.

Rape Oil is of low toxicity concern to aquatic and terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Rape Oil

CAS RN: 8002-13-9

Molecular formula: Unspecified

Molecular weight: Unspecified

Synonyms: Rape Oil; Rapeseed oil; Rapeseed oil, acidulated soapstock

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of Rape Oil

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Liquid	-	NCBI, 2026
Melting Point	-29.5°C @ 101.3 kPa	-	BPDB[1]
Boiling Point	>412°C @ 101.3 kPa	-	BPDB
Density	914 kg/m^3 (temperature not indicated)	-	BPDB
Vapor Pressure	Negligible	-	BPDB
Partition Coefficient (log K_{ow})	23.3	-	BPDB
Water Solubility	0.000001 g/L @ 20°C	-	BPDB
Dissociation constant (pKa)	Not applicable, no dissociation	-	BPDB
Viscosity	Not available	-	BPDB

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for Rape Oil.

NICNAS has assessed Rape Oil in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to human health and the environment[2][3].

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

[1] https://sitem.herts.ac.uk/aeru/bpdb/Reports/2528.htm
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=9652433e-f36b-1410-8924-008e64e216c7
[3] https://services.industrialchemicals.gov.au/assessment-detail/?id=93e4433e-f36b-1410-8e4e-00f1fcf8411a

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Rape oil is readily biodegradable. It is not expected to bioaccumulate. It would be expected to be essentially immobile in soil.

B. Biodegradation

Under the conditions of a ready biodegradability study (OECD study guideline 301F) that utilises a sewage sludge inoculum, the C9fatty acid pelargonic acid was demonstrated to be readily biodegradable (EFSA, 2013).

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

Triglycerides of fatty acids would be expected to be essentially immobile in soil, based on accepted quantitative structure activity relationship (QSAR) estimates for triglyceride esters of oleic acid (EFSA, 2013).

D. Bioaccumulation

No studies were available as the substance. Rape Oil is not considered to be bioaccumulative (EFSA, 2013).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Rape Oil is of low toxicity concern to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on Rape Oil.

Table 3: Acute Aquatic Toxicity Studies on Rape Oil

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Oncorhynchus mykiss	96-hr LC_{50}	192	2	BPDB
Daphnia magna	48-hr EC_{50}	91	2	BPDB
Desmodesmus subspicatus	72-hr EC_{50}	39	2	BPDB

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on Rape Oil.

Table 4: Chronic aquatic toxicity studies on Rape Oil

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Danio rerio	35-day NOEC	19.6	2	BPDB
Daphnia magna	21-day NOEC	1.34	2	BPDB

C. Terrestrial Toxicity

A NOEC of 3,550 mg/kg soil dw was determined in *Eisenia foetida* based on reproduction (BPDB).

The 10-day LDD_{50} from a chronic honeybee test on Rape Oil was 1421 µg/bee (BPDB).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Rape Oil is readily biodegradable; thus, it does not meet the screening criteria for persistence.

Rape Oil is not considered to be bioaccumulative, thus it does not meet the screening criteria for bioaccumulation.

The lowest chronic NOEC for Rape Oil is >0.1 mg/L. The acute $E(L)C_{50}$ values are >1 mg/L. Thus, Rape Oil does not meet the screening criteria for toxicity.

The overall conclusion is that Rape Oil is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for Rape Oil.

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8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
Rape Oil	8002-13-9	Not a PBT	No	No	No	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICIS	Australian Industrial Chemicals Introduction Scheme
AICS	Australian Inventory of Chemical Substances
COC	constituent of concern
EC	effective concentration

ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
KI	Klimisch scoring system
KOCWIN™	USEPA organic carbon partition coefficient estimation model
kPa	kilopascal
L	litre
L/kg	litres per kilogram
LC	lethal concentration
LD	lethal dose
m^3	cubic metre
MCI	molecular connectivity index
mg/kg	milligrams per kilogram
mg/L	milligrammes per litre
mg/m^3	milligrams per cubic metre
mL	millilitre
mPa s	millipascal second
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

SILICIC ACID, POTASSIUM SALT
SILICIC ACID, LITHIUM MAGNESIUM SODIUM SALT

This dossier on silicic acid, potassium salt (potassium silicate) and similar silicic acid, lithium magnesium sodium salt (lithium magnesium sodium silicate) presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. It does not represent an exhaustive or critical review of all available data. The information presented in this dossier was obtained from the OECD-SIDS documents on Soluble Silicates, which includes potassium silicate (OECD, 2004) and the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Silicic acid, potassium salt is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

Silicic acid, potassium salt or potassium silicate is an amorphous glass, and it is solidified as a glass from the melt (solid or lump glasses). It is essentially anhydrous and differs from ordinary glasses in that it is soluble in water at elevated temperature and pressure, leading to silicate solutions (liquid glasses). Both solid and liquid glasses are often referred to as waterglass. Silicate solutions are defined by their density and viscosity, which together with the MR defines a unique composition for the silicate solution. By evaporation of silicate solutions, fine powders or granules are obtained that have a residual water content of approximately 20%. Unlike ground lump glass, these materials dissolve readily in water to give silicate solutions (OECD, 2004).

Upon dissolution in water, potassium silicate forms potassium ions (K^+) and molecular speciation of silicates. Depending on both pH and concentration the respective solutions contain varying proportions of monomeric tetrahydral ions, oligomeric linear or cyclic silicate ions (OECD, 2004). Lithium magnesium sodium silicate is expected to behaves similarly.

Silicic acid, potassium salt or potassium silicate is an amorphous glass in the form of fine powders or granules. As an inorganic substance, it is not amenable to biodegradation; it is not expected to bioaccumulate. Potassium silicate, and lithium magnesium sodium silicate by read-across, is of low toxicity concern to aquatic organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Potassium hydroxyl(oxo)silanolate

CAS RN: 1312-76-1

Molecular formula: $K_2O \cdot nO_2Si$

Molecular weight: 248.44 g/mol (tetrapotassium orthosilicate); soluble silicates are not generally stoichiometric chemical substances (with a specific chemical formula and molecular weight), but rather glasses or aqueous solutions of glasses.

Synonyms: Potassium silicate; potassium waterglass; potassium polysilicate; silicic acid, potassium salt; soluble potash glass

Chemical Name (IUPAC): Lithium magnesium sodium silicate (1/1/1/1)

CAS RN: 53320-86-8

Molecular formula: $LiMgNaO_4Si$

Molecular weight: 146.32 g/mol; soluble silicates are not generally stoichiometric chemical substances (with a specific chemical formula and molecular weight), but rather glasses or aqueous solutions of glasses.

Synonyms: silicic acid, lithium magnesium sodium salt; lithium magnesium sodium silicate

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for potassium silicate are shown in Table 1. Limited information was available for lithium magnesium sodium silicate.

Table 1 Overview of the Physico-Chemical Properties of Potassium Silicate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Amorphous glass melt; aqueous solution of spray-dried powder with ~20% residual water	-	OECD, 2004
Melting Point	905°C (Flow Point*)	2	ECHA
Boiling Point	*	-	ECHA
Density	1260–1600 kg/m^3 (solution) @ 20°C; 750 kg/m^3 spray-dried powder	2	ECHA
Vapor Pressure	Negligible at ambient temperature	-	OECD, 2004
Partition Coefficient (log Kow)	Not relevant	-	OECD, 2004
Dissociation Constant (pKa)	9.9, 11.8, 12 @ 30 °C	2	ECHA
Water Solubility	Solution: infinitely miscible; spray-dried solution: readily dissolvable	-	OECD, 2004
Viscosity	950 mPa s @ 25 °C (for an aqueous solution)	2	ECHA

*Due to their glass nature, solid amorphous silicates do not have discrete melting points but rather flow points.

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for silicic acid, potassium salt or silicic acid, lithium magnesium sodium salt.

NICNAS has assessed silicic acid, potassium salt in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to the environment.[1]

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

Potassium silicate readily dissolves in water to potassium ions (K^+) and molecular speciation of silicates. Dissolved silica from commercial soluble silicates is indistinguishable from natural dissolved silica. Silica (SiO_2) represents about 59% of the elemental composition of the earth's crust. Similar percentages are obtained for many sediments and soils (Jackson, 1964). Compounds of silicon and oxygen are ubiquitous in the environment; they are present in inorganic matter (i.e., minerals and soils) and in organic matter.

Silica is found in all natural waters and the median values in the United States were reported to be 17 mg SiO_2/L for ground waters and 14 mg SiO_2/L for streams (Davis, 1964). The world-wide concentration in rivers is 13 mg SiO_2/L (Edwards and Liss, 1973).

Potassium silicate is an inorganic substance and therefore not amenable to biodegradation. It is not expected to bioaccumulate.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Potassium silicate is of low toxicity concern to aquatic organisms. All available aquatic ecotoxicity tests with potassium silicate and with sodium silicate (used as read across for algae) show toxicity at concentrations well above 100 mg/L.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on potassium silicate.

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=278c433e-f36b-1410-8c14-0026b2c59b62

Table 3 Acute Aquatic Toxicity Studies on Potassium Silicate

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Leuciscus idus (Ide)	48-hour LC_{50}	>146	2	OECD, 2004; ECHA
Daphnia magna	24-hour EC_{50}	>146	2	OECD, 2004; ECHA
Scenedesmus subspicatus	72-hour EC_{50}	>345.4*	2	OECD, 2004; ECHA

*Test material was sodium silicate (CAS No. 1344-09-8).

Chronic Studies

No chronic studies are available. However, dissolved silica is indistinguishable from naturally dissolved silica, which is ubiquitous in the environment. Depending on pH values, reaction with naturally occurring dissolved polyvalent metals such as Ca, Mg, Fe, and Al, will result in insoluble silicates or amorphous silica being formed. These products occur in abundance in natural soils and rocks. In fact, silica is the second most abundant element on earth (ECHA; OECD, 2004). Silicon is also the primary constituent of the frustules of diatoms and is taken up by diatoms from the ambient water and incorporated into their skeleton (HERA, 2005). Due to the natural adaptation of organisms to silicon, it can be assumed that the additional input of anthropogenic soluble silicates will not lead to an increased hazard potential for aquatic organisms. Chronic aquatic toxicity is therefore not anticipated (ECHA).

C. Terrestrial Toxicity

A honeybee acute contact toxicity study (USEPA OCSPP 850.3020) was conducted on AgSil™ 25 potassium silicate solution (29.1% potassium silicate in water). The 48-hour LD_0 was 25 µg/animal and the 48-hour LD_{50} was 25 µg/animal (ECHA).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Potassium silicate is an inorganic compound that dissociates completely to potassium and silicate ions in aqueous solutions. Biodegradation is not applicable to these inorganic ions; both potassium and silicate ions are also ubiquitous and are present in most water, soil and sediment. For the purposes of this PBT assessment, the persistent criteria are not considered applicable to this inorganic compound.

Potassium and silicate ions are essential to all living organisms and are ubiquitous in the environment. Therefore, potassium silicate is not expected to bioaccumulate.

No chronic aquatic toxicity data exist on potassium silicate; however, the acute EC_{50} values are >1 mg/L in fish, invertebrates and algae. Therefore, potassium silicate does not meet the screening criteria for toxicity.

The overall conclusion is that potassium silicate is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for potassium silicate.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Silicic Acid, Potassium Salt	1312-76-1	Not a PBT	No	No	NA	No	No	No	1	1	1
Silicic acid, lithium magnesium sodium salt	53320-86-8	Not a PBT	No	No	NA	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg/m^3	kilograms per cubic metre
LC	lethal concentration

LD	lethal dose
mg	milligram
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
OCSPP	Office of Chemical Safety and Pollution Prevention
OECD	Organisation for Economic Co-operation and Development
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
SIDS	Screening Information Data Set
USEPA	United States Environmental Protection Agency
µg	microgram

SILOXANES AND SILICONES, DIMETHYL, REACTION PRODUCTS WITH SILICA (CAS RN 67762-90-7)
DIMETHYL SILOXANES AND SILICONES (CAS RN 63148-62-9)
SILANE, DICHLORODIMETHYL-, REACTION PRODUCTS WITH SILICA (CAS RN 68611-44-9)

This group contains information on dimethyl siloxanes and silicones (CAS RN 63148-62-9), siloxanes and silicones, dimethyl, reaction products with silica (CAS RN 67762-90-7) and silane, dichlorodimethyl-, reaction products with silica (CAS RN 68611-44-9). They are expected to have similar environmental concerns and have consequently been assessed as a group. Information provided in this dossier is based on dimethyl siloxanes and silicones (CAS RN 63148-62-9).

This dossier presents the most critical studies pertinent to the risk assessment of the siloxanes and their use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): dimethyl-bis(trimethylsilyloxy)silane

CAS RN: 63148-62-9

Molecular formula: $C_8H_{24}O_2Si_3$

Molecular weight: 236.53 g/mol

Synonyms: polydimethylsiloxanes (PDMS); octamethyltrisiloxane;, trislocane; octamethyl-;dimeticone,

SMILES: C[Si](C)(C)O[Si](C)(C)O[Si](C)(C)C

Chemical Name (IUPAC): Siloxanes dimethyl reaction products with silica

CAS RN: 67762-90-7

Molecular formula: UVCB substance

Molecular weight: No information is available

Synonyms: hydrophobic silica; PDMS, silicon dioxide reaction product; siliconized silica

SMILES: Not applicable

Chemical Name (IUPAC): silane, dichlorodimethyl-, reaction products with silica

CAS RN: 686411-44-9

Molecular formula: $C_2H_6Cl_2Si.O_2Si$

Molecular weight: 189.14 g/mol

Synonyms: hydrophobic fumed silica; (modified) silicon dioxide; silica, hydrophobic colloidal

SMILES: O=[Si]=O.Cl[Si](Cl)(C)C

II. PHYSICAL AND CHEMICAL PROPERTIES

Table 1: Overview of the Physico-chemical Properties of PDMS (CAS RN 63148-62-9 and related CAS 9016-00-6)

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Colourless, odourless, liquid	-	NCBI, 2026
Melting Point	-50.0°C (pressure not provided)	-	NCBI, 2026
Boiling Point	> 150°C @ 101.3 kPa	-	NCBI, 2026
Density	834 kg/m^3 @ 25°C	-	NCBI, 2026
Vapour Pressure	Not available	-	NCBI, 2026
Partition Coefficient (log K_{ow})	8.21 @ 22°C	-	ECETOC, 20111
Water Solubility	Insoluble	-	NCBI, 2026

No data was available for hydrophobic silica (CAS RN 67762-90-7) and hydrophobic fumed silica (CAS RN 68811-44-9). As a result, the information provided in this dossier is based on PDMS. PDMS (CAS RN 63148-62-9), hydrophobic silica (CAS RN 67762-90-7) and hydrophobic fumed silica (CAS RN 68811-44-9) are linear siloxanes. Siloxanes are the general name for oligomeric or polymeric substances which are characterised by Si-O-Si bonds, methyl groups are usually bound to Si-atoms, but some siloxanes contain vinyl, hydroxyl or other groups in addition (ECETOC, 2011).

NICNAS has assessed PDMS in an IMAP Tier 1 assessment and considers it a polymer of low concern, and concluded that it poses no unreasonable risk to human health and the environment[1] .

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Siloxanes are linear non-volatile substances which are insoluble in water, preferentially strongly adsorb to soil and sediment, and not readily biodegradable. However, they have a low potential for bioaccumulation.

[1] https://www.industrialchemicals.gov.au/chemical-information/search-assessments?assessmentcasnumber=63148-62-9

B. Biodegradation

Siloxanes will likely break down slowly via biotic and abiotic processes. Under field conditions, the half-life in soil was 2.4 to 3.9 years. In freshwater sediments, 5 to 10% PDMS was hydrolysed after 1 year (ECETOC, 2011).

If a chemical is found to be not readily or inherently biodegradable, it is categorised as Persistent since its half-life is greater than 60 days (DoEE, 2017).

C. Environmental Distribution

No experimental data are available for siloxanes. However, the soil organic partition coefficient (log K_{oc}) value of 5.162 L/kg (MCI method) was estimated using USEPA EPI Suite™ KOCWIN v2.00 module. Based on this estimated value, the substance is expected to sorb substantially to soils or sediments.

D. Bioaccumulation

There is no evidence of PDMS bioaccumulating in aquatic or terrestrial organisms. Bioconcentration studies suggest that due to their molecular size the potential for PDMS fluids to pass biological membranes, neither the gills nor the gastro-intestinal tract, is very unlikely (ECETOC, 2011).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Siloxanes exhibits low acute toxicity by the oral, inhalation and dermal routes. They are non-irritating to the skin and mildly irritating to the eyes. Siloxanes are not a skin sensitiser. In repeated dose toxicity studies, no systemic effects were observed. It is not genotoxic or carcinogenic. No reproductive or developmental effects were observed.

Information provided within this section was obtained from *ECETOC JACC Report No. 55: Linear Polydimethylsiloxanes* as read-across for siloxanes (ECETOC, 2011). [Kl. Score = 2].

B. Acute Toxicity

Oral

The acute oral LD_{50} of PDMS was determined to be > 4,800 mg/kg bw/day in Wistar rats.

Dermal

The acute dermal LD_{50} of PDMS was reported to be > 2,000 mg/kg bw/day. It was also determined that siloxanes do not penetrate the skin.

Inhalation

In an OECD Guideline 403 (inhalation) study, Wistar rats were exposed to PDMS via the nose for four hours. The LC_{50} was determined to be 695 mg/m^3.

C. Irritation

Skin

PDMS mainly causes reversible irritation under extreme conditions like occlusion. Siloxanes are generally considered non-irritating to human skin under normal conditions of use.

Eye

PDMS was found to be mildly irritating to the eye due to conjunctival reactions observed in animal studies.

D. Sensitisation

PDMS is not expected to be sensitising to human skin based on the results from a clinical HRIPT.

E. Repeated Dose Toxicity

Oral

In a combined chronic toxicity and oncogenicity study, PDMS was administered to 30 Fischer 344 rats via their diet at dose levels of 0, 100, 300 or 1,000 mg/kg bw/day for 24 months. Ten animals were necropsied following 12 months of treatment. 20 animals were treated for 12 months followed by a 12-month recovery period. Possible substance-related findings were limited to increased incidences of eye opacity in the chronic recovery group. The NOEL for systemic toxicity was determined to be 1,000 mg/kg bw/day, the highest tested dose.

Inhalation

No data were available .

Dermal

In a 4-week study, siloxanes were dermally administered to New Zealand White rabbits. After 6 hours of exposure, the animals were observed daily for 29-30 days. Dermal application of siloxanes was considered non-toxic and the NOAEL for this study was reported to be 1,000 mg/kg bw/day.

F. Genotoxicity

In Vitro Studies

The results of the *in vitro* genotoxicity studies on PDMS based are presented in Table 2.

Table 2: *In Vitro* Genotoxicity Studies on Siloxanes

Test System[1]	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay) S. typhimurium	-	-	2	ECETOC, 2011

Test System[1]	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay) Salmonella typhimurium (TA98, TA100, TA135, TA1537, and TA1538)	-	-	2	ECETOC, 2011

*+, positive; -, negative.

In Vivo Studies

No data were available.

G. Carcinogenicity

Oral

In a combined chronic toxicity and oncogenicity study, PDMS was administered to 60 Fischer 344 rats via their diet at dose levels of 0, 100, 300 or 1,000 mg/kg bw/day for 24 months. No substance-related neoplastic or pre-neoplastic changes were observed. The NOEL for oncogenicity was 1,000 mg/kg bw/day, the highest tested dose. There was no indication of carcinogenicity of PDMS.

Inhalation

No data were available.

Dermal

No data were available.

H. Reproductive Toxicity

Oral

Male Sprague-Dawley rats were exposed to PDMS via their drinking water for four weeks. No clinical signs of toxicity were noted. The NOAEL for this study was reported to be > 1,000 mg/kg bw/day.

Dermal

Albino rabbits were exposed to PDMS via dermal application for four weeks. There were no reproductive effects observed following dermal application of siloxanes. The NOAEL was reported to be > 3,000 mg/kg bw/day.

Charles River CD rats were implanted with a cross-linked silicone gel for up to 61 days. There was no treatment-related mortality reported. No differences in behaviour and general condition, body weight gain or reproductive behaviour and success were recorded in the parental generation. The NOAEL was reported to be 28,500 mg/kg bw/day in dams and offspring.

I. Developmental Toxicity

The teratogenicity of PDMS was evaluated using in pregnant New Zealand White rabbits. Dose levels ere 3, 10, or 30 ml/kg bw/day. Rabbits were implanted 6 weeks prior to insemination. On Day 29 of gestation all surviving animals were necropsied. There were no significant differences between treated and untreated mice. There were also no adverse effects observed in this study. The maternal and developmental NOAEL was 30 ml/kg bw/day (28,500 mg/kg bw/day).

In another study, three groups of 23 pregnant New Zealand White rabbits were administered siloxanes via oral gavage. There were no reproductive changes observed. The NOAEL was determined to be 1,000 mg/kg bw/day.

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for siloxanes follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2021).

A. Non-Cancer

Oral

The NOAEL from a rat 2-year oral feeding study on PDMS was reported to be 1,000 mg/kg bw/day. This NOAEL will be used for determining the oral reference dose (RfD) and the drinking water guidance value for siloxanes.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

- UF_A (interspecies variability) = 10
- UF_H (intraspecies variability) = 10
- UF_L (LOAEL to NOAEL) = 1
- UF_{Sub} (subchronic to chronic) = 1
- UF_D (database uncertainty) = 1
- Oral RfD = 1000/(10 x 10 x 1 x 1 x 1 x 1) = 1000/100 = 10 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2021)
Proportion of water consumed = 10% (ADWG, 2021)
Volume of water consumed = 2L (ADWG, 2021)
Drinking water guidance value = (10 x 70 x 0.1)/2 = 70/2 = 35 mg/L

B. Cancer

Siloxanes are not considered carcinogens. Thus, a cancer reference value will not be calculated for this substance.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Siloxanes are potentially combustible. Siloxanes do not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Siloxanes are of low toxicity concern to aquatic, sediment-dwelling and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity data for PDMS.

Table 3: Acute Aquatic Toxicity Studies on PDMS

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Chanel Catfish (*Ictalurus punctatus*)	72-hour LC_{50}	5.5	2	ECOTOX
Daphnia magna	48-hour LC_{50}	44.5	2	ECOTOX

Chronic Studies

A 7-day fish (*Ictalurus punctatus*) freshwater study was identified in ECOTOX. The reported LC_{50} was 3.16 mg/L [Kl. Score = 2].

C. Sediment Toxicity

Table 4 lists the results of chronic toxicity data for PDMS in sediment-dwelling organisms.

Table 4: Chronic Sediment Toxicity Studies on PDMS

Test Species	Endpoint	Results (mg/kg dw)	Klimisch score	Reference
Chironomus tentans (midge larva)	20-day NOEC	>2,590	2	ECETOC, 2011
Chironomus tentans	14-day NOEC	>560[a]	2	ECETOC, 2011
Hyallela azteca (freshwater amphipod)	28-day NOEC	<2,200	2	ECETOC, 2011
Hyallela azteca	42-day NOEC	>994	2	ECETOC, 2011
Nereis diversicolor (marine polychaeta, ragworm)	28-day NOEC	>1,000	2	ECETOC, 2011

a – maximum concentration tested in the study. No effects observed at any tested concentration.

D. Terrestrial Toxicity

Table 5 lists the results of chronic toxicity data for PDMS in soil-dwelling organisms.

Table 5: Chronic Terrestrial Toxicity Studies on PDMS

Test Species	Endpoint	Results (mg/kg dw)	Klimisch score	Reference
Eisenia foetida (earthworms)	21-day NOEC	>1,100	2	ECETOC, 2011
Folsomia candida (springtail)	28-day NOEC[a]	230	2	ECETOC, 2011
Soil microflora	28-day NOEC	>1,000	2	ECETOC, 2011

a – soil microflora activity evaluated on day 0, 14 and 28 and on day 58 for mineralization only

E. Calculation of PNEC

The PNEC calculations for siloxanes follow the methodology discussed in DEWHA (2009).

PNEC water

Experimental results are available for two trophic levels. Acute E(L)C_{50} values are available for fish (5.5 mg/L) and *Daphnia* (45.5 mg/L). Results from chronic studies are also available for fish (3.16 mg/L). On the basis that the data consists of short-term and long-term results from two trophic levels, an assessment factor of 50 has been applied to the lowest reported LC_{50} value of 3.16 mg/L for fish. Therefore, the $PNEC_{water}$ is 0.0632 mg/L.

PNEC sediment

Siloxanes are expected to partition more readily to the sediment phase rather than the aquatic phase. No adverse effects were observed in any of the chronic studies on sediment-dwelling organisms. Results are available for three trophic levels and the lowest NOEC is 560 mg/kg dw. An assessment factor of 50 has been applied to this value. Therefore, the $PNEC_{sediment}$ is 11.2 mg/kg .

PNEC soil

Results are available for three tropic levels (soil mico-organisms, earthworms and arthropods) and the lowest NOEC is 230 mg/kg dw for *Folsomia*. An assessment factor of 10 has been applied to the lowest NOEC value. Therefore, the $PNEC_{soil}$ is 23 mg/kg.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Siloxanes are not readily biodegradable. Thus, they meet the screening criteria for persistence.

There is no evidence of PDMS bioaccumulating in aquatic or terrestrial organisms. Bioconcentration studies suggest that due to their molecular size the potential for PDMS fluids to pass biological membranes, neither the gills nor the gastro-intestinal tract, is very unlikely (ECETOC, 2011). Thus, siloxanes do not meet the screening criteria for bioaccumulation.

The chronic toxicity data on PDMS show NOECs of > 0.1 mg/L. Acute LC50 values are > 1.0 mg/L. Thus, siloxanes do not meet the screening criteria for toxicity.

The overall conclusion is that siloxanes are not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Not classified.

B. Signal word

No signal word.

C. Pictogram

None.

X. SAFETY AND HANDLING

A. First Aid

Please refer to the product SDS for additional information.

B. Fire Fighting Information

Not available.

Wear self-contained breathing apparatus and chemical-protective clothing.

C. Accidental Release Measures

Not available.

D. Storage And Handling

Not available.

E. Exposure Controls / Personal Protection

Not available.

F. Transport Information

Not available.

XI. DISPOSAL MANAGEMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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SODIUM ACID PYROPHOSPHATE
SODIUM POLYPHOSPHATE

This dossier on sodium acid pyrophosphate and sodium polyphosphate presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. It does not represent an exhaustive or critical review of all available data. Limited information is available for sodium polyphosphate, which like sodium acid pyrophosphate, is a phosphoric acid sodium salt. Therefore, information provided in this dossier is based on sodium acid pyrophosphate.

The information presented in this dossier was obtained primarily from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Sodium acid pyrophosphate and sodium polyphosphate are classified as **tier 1** chemicals and require a hazard assessment only.

1 BACKGROUND

Sodium acid pyrophosphate is an inorganic salt. It is widely used in food processing, and in the United States, it is classified as generally recognized as safe (GRAS) for food use. In petroleum production, it can be used as a dispersant in oil well drilling muds. Sodium polyphosphate is an inorganic polyphosphate salt commonly used as a corrosion inhibitor, emulsifying agent and as a tooth whitening agent in dentifrice formulations.

Both substances dissociate completely in aqueous media to sodium ions (Na^+) and pyrophosphate ions ($P_2O_7^{4-}$). The pyrophosphate anion is unstable in aqueous solution and hydrolyses into inorganic phosphate. Both sodium ions (Na^+) and phosphate ions (HPO_4^{2-}) are ubiquitous in the environment. Both ions are essential to all living organisms and their intracellular and extracellular concentrations are actively regulated. Neither sodium acid pyrophosphate, sodium polyphosphate nor its dissociated ions are expected to bioaccumulate. Sodium acid pyrophosphate and sodium polyphosphate are expected to be of low toxicity concern to aquatic organisms based on a similar compound.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): disodium dihydrogen (phosphonatooxy) phosphonate

CAS RN: 7758-16-9

Molecular formula: $H_2Na_2O_7P_2$

Molecular weight: 221.94 g/mol

Synonyms: sodium acid pyrophosphate; sodium pyrophosphate; disodium dihydrogen pyrophosphate; pyrophosphoric acid, disodium salt

Chemical Name (IUPAC): polyphosphoric acids, sodium salts

CAS RN: 68915-31-1

Molecular formula: $H_{(n+2)}\ O_{(3n+1)}P_n$ where n is not less than 2

Molecular weight: $(102)_n$ g/mol (for the polyphosphate)

Synonyms: sodium polyphosphate; sodium hexametaphosphate; phosphoric acids, sodium salts; polyphosphate sodium salts

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Sodium Acid Pyrophosphate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	white solid	1	ECHA
Melting Point	> 450°C (pressure not provided)	1	ECHA
Boiling Point	No data as the substance is a solid which melts above 300°C	-	ECHA
Density	2630 kg/m^3 @ 22.5°C	1	ECHA
Vapor Pressure	Not applicable	-	ECHA-
Partition Coefficient (log K_{ow})	Not applicable, substance is inorganic	-	ECHA
Dissociation constant (pKa)	0.9-9.42 @ 25°C	2	ECHA
Water Solubility	170 g/L @ 20°C	1	ECHA
Viscosity	Not applicable, substance is a solid	-	ECHA

Soluble sodium polyphosphates are obtained by fusion and subsequent chilling of sodium orthophosphates. These compounds are a class consisting of several amorphous, water-soluble polyphosphates composed of linear chains of metaphosphate units, $(NaPO_3)_x$ where $x \geq 2$, terminated by Na_2PO_4 groups. These substances are usually identified by their Na_2O/P_2O_5 ratio or their P_2O_5 content. The Na_2O/P_2O_5 ratios vary from about 1.3 for sodium tetrapolyphosphate, where x = approximately 4; to about 1.1 for Graham's salt, commonly called sodium hexametaphosphate,where x = 13 to 18; and to about 1.0 for the higher molecular weight sodium polyphosphates, where x = 20 to 100 or more. The pH of their solutions varies from 3.0 to 9.0 (EFSA, 2019).

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for sodium acid pyrophosphate or sodium polyphosphate.

NICNAS has assessed sodium acid pyrophosphate in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to the environment. It is an inorganic substance comprising ions of low ecotoxicological concern. This chemical is not expected to pose an unreasonable risk to the environment provided that ANZECC[1] water quality guidelines for physical and chemical stressors are not exceeded. [2]

NICNAS has assessed sodium polyphosphate in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to human health.[3]

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

As an inorganic substance, sodium acid pyrophosphate is expected to disassociate completely in aqueous media to sodium ions (Na^+) and pyrophosphate ions ($P_2O_7^{4-}$). The pyrophosphate anion is unstable in aqueous solution and hydrolyses into inorganic phosphate:

$$P_2O_7^{4-} + H_2O \rightarrow 2HPO_4^{2-}.$$

Both (Na^+) and phosphate ions (HPO_4^{2-}) are ubiquitous in the environment. Both ions are essential to all living organisms and their intracellular and extracellular concentrations are actively regulated (Ganong, 1995). Neither sodium acid pyrophosphate nor its dissociated ions are expected to bioaccumulate.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Sodium acid pyrophosphate is of low toxicity concern to aquatic and terrestrial organisms. Details are provided below.

[1] Water quality guidelines were revised in 2018 and are now referred to as Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG)

[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=0c65433e-f36b-1410-8de4-00e8f2afc108

[3] https://services.industrialchemicals.gov.au/assessment-detail/?id=8452433e-f36b-1410-8924-008e64e216c7

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on sodium acid pyrophosphate.

Table 3 Acute Aquatic Toxicity Studies on Sodium Acid Pyrophosphate

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Freshwater fish	96-hour LC_{50}	100 mg/L[1]	1	ECHA
Daphnia magna	48-hour EC_{50}	>100 mg/L[1]	1	ECHA
Desmodesmus subspicatus	72-hour EC_{50}	>100 mg/L[1]	1	ECHA

1 – based on read across to phosphoric acid, potassium salt (2:3), dihydrate (CAS RN. 66922-99-4)

Chronic Studies

No chronic studies were identified in fish and invertebrates. In an OECD Guideline 201 (Alga, Growth Inhibition Test) on *Desmodesmus subspicatus* (green algae) using read-across substance phosphoric acid, potassium salt (2:3), dihydrate (CAS RN. 66922-99-4) a 72-hour NOEC of 100 mg/L was determined (ECHA). [Kl. Score =1]

C. Terrestrial Toxicity

Table 4 lists the results of terrestrial toxicity studies conducted on sodium acid pyrophosphate.

Table 4 Terrestrial Toxicity Studies on Sodium Acid Pyrophosphate*

Test Species	Endpoint	Results (mg/kg soil dw)	Klimisch Score	Reference
Eisenia foetida	14-day LC_{50}	> 3,500	2	ECHA

*Study used test material potassium hydrogen phosphate (CAS RN 7778-77-0)

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Sodium acid pyrophosphate is an inorganic salt that dissociates to its respective cations and anions in aqueous solutions. Biodegradation is not applicable to these inorganic ions. For the purposes of this PBT assessment, the persistence criteria are not considered applicable to this inorganic salt.

Sodium and phosphate ions are essential to all living organisms and their intracellular and extracellular concentrations are actively regulated. Therefore, sodium acid pyrophosphate is not expected to bioaccumulate.

The NOEC from the chronic aquatic toxicity study on sodium acid pyrophosphate is >0.1 mg/L. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies on sodium acid pyrophosphate are >1 mg/L. Thus, sodium acid pyrophosphate does not meet the criteria for toxicity.

The overall conclusion is that sodium acid pyrophosphate is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for sodium acid pyrophosphate.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Sodium acid pyrophosphate	7758-16-9	Not a PBT	No	No	NA	No	No	No	1	1	1
Sodium polyphosphate	68915-31-1	Not a PBT	No	No	NA	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
ANZECC	Australian and New Zealand Environment and Conservation Council
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
dw	dry weight
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard
IMAP	Inventory Multitiered Assessment and Prioritisation
IUPAC	International Union of Pure and Applied Chemistry

kg/m^3	kilograms per cubic metre
kPa	kilopascal
LC	lethal concentration
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NOEC	no observed effective concentration
PBT	Persistent, Bioaccumulative and Toxic
PEC	Predicted exposure concentrations
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases

SODIUM ALUMINATE

This dossier on sodium aluminate presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. It does not represent an exhaustive or critical review of all available data. The information presented in this dossier was obtained the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Sodium aluminate was not identified in chemical databases used by NICNAS as an indicator that the chemical is of concern and is not a PBT substance. However, decomposition by-product dissolved aluminium was assessed as a tier 3 chemical for acute toxicity and as a tier 3 chemical for chronic toxicity in acidic environments, which overestimates the toxicity of sodium aluminate itself. Therefore, sodium aluminate is classified overall as a **tier 2** chemical and requires a hazard assessment and qualitative assessment of risk..

1 BACKGROUND

Sodium aluminate is a strong alkaline substance that dissociates completely in water to sodium (Na^+), aluminium (Al^{3+}) and hydroxyl (OH^-) ions. Sodium is an essential element for all living organisms. Thus, bioaccumulation in organisms is not relevant for sodium ions. Based on the data available, aluminium is considered to have a low bioaccumulation potential to aquatic organisms under circum neutral conditions

Due to its chemical nature sodium aluminate is not stable under environmental conditions (pH-values between 4 and 9). The main decomposition products of sodium aluminate in water are 1) sodium hydroxide (NaOH), 2) aluminium hydroxide and its dehydrate form, aluminium oxide.

The OECD-SIDS SIAR on NaOH states that while the toxicity of the NaOH has been assumed to be related to the hydroxyl anion, in general, a pH change could influence the speciation of other chemicals and therefore, increase and/or decrease toxicity of the substance. Available data indicate that aluminium salts are relatively non-toxic in most waters with circumneutral pH. Factors that influence aluminium toxicity are consistent with the factors that
influence aluminium speciation. These factors include pH, dissolved organic carbon (DOC), and water hardness.

There were no studies available in which the toxicokinetic properties of sodium aluminate were investigated. Thus, information available on supporting substances was taken into account by read-across following a structural analogue approach. Aluminium compounds were considered for this approach, since the pathways leading to toxic outcomes are dominated by the chemistry and biochemistry of the aluminium ion (Al^{3+}) (ECHA)

Following absorption by any route of exposure, aluminium is present in the body as the ionic species (Al_3^+) which is consequently the determining driver regarding the systemic effects of aluminium salts. Sodium aluminate has low acute toxicity by the oral and inhalation routes. It is corrosive to the skin and mucous membranes. However, it is not a skin sensitiser. Systemic effects associated with neurotoxicity have been identified from repeated dose toxicity studies. Sodium aluminate is not genotoxic nor carcinogenic.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): sodium dioxoalumanuide

CAS RN: 1302-42-7

Molecular formula: $AlNaO_2$

Molecular weight: 81.970 g/mol

Synonyms: sodium aluminate; aluminium sodium dioxide; aluminate, sodium; sodium aluminium oxide

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-Chemical Properties of Sodium Aluminate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	White solid	2	ECHA
Melting Point	1650°C @ 101.3 kPa	2	ECHA
Boiling Point	Not relevant, solid with a melting point above 300°C	2	ECHA
Density	2600 kg/m^3 @ 20°C	1	ECHA
Vapor Pressure	Not applicable	-	ECHA
Partition Coefficient (log K_{ow})	Not applicable, substance is inorganic	-	ECHA
Dissociation Constant (pKa)	Does not dissociate under naturally relevant pH conditions	-	ECHA
Water Solubility	Soluble	2	ECHA
Viscosity	Not Applicable, substance is a solid	-	ECHA

Sodium aluminate is a strong alkaline substance that dissociates completely in water to sodium (Na^+), aluminium (Al^{3+}) and hydroxyl (OH^-) ions.

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for sodium aluminate.

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

Sodium aluminate is stable only in alkaline conditions. If released to the environment, sodium aluminate hydrolyses rapidly under environmental conditions to aluminium hydroxide and as a result precipitates in aquatic systems or deposits as aluminium oxide in sediment or soil, whereas the sodium part will be found dissociated as sodium ions predominantly in water. Based on the transformation/dissolution study, at pH 6, both aluminium hydroxide and aluminium oxide, showed very low release (approximately 3 µg/L) of dissolved aluminium species. The same was found for aluminium hydroxide at pH 8 and aluminium oxide at pH 8 by the loading of 1 mg/L (ECHA).

Sodium aluminate is an inorganic substance, which is not amenable to biodegradation. When diluted in the aquatic environment, sodium aluminate is hydrolysed rapidly to form insoluble aluminium hydroxide and free sodium ions. Sodium is an essential element for all living organisms. Thus, bioaccumulation in organisms is not relevant for sodium ions.

Bioconcentration of aluminium in fish is a function of the water quality (e.g. pH and total organic carbon). Cleveland et al. (1991) (as cited in ECHA) maintained brook trout (Salvelinus fontinal) in water containing 200 µg/L total aluminium at pH values of 5.0, 6.0 and 7.2 for 56 days. Estimated steady state bioconcentration factors (BCFs) for aluminium were 215 at pH 5.3, 123 at pH 6.1 and 36 at pH 7.2, respectively. The estimated time to reach a 90% steady state was 1.5 days at pH 5.3, 4.2 days at pH 6.1 and 1.7 days at pH 7.2. These data demonstrate that the BCFs are inversely related to pH (ECHA).

Steady state BCF values as high as 14,000 have been reported in *Asellus aquaticus* after a 20-day exposure to aluminium (Goossenaerts and Grieken, 1988 as cited in ECHA). Similar, a steady state BCF of 19, 000 was reported for the gut tissue of the freshwater snail *Lymnaea stagnalis* by Elangovan et al., (1997). Moreover, high aluminium concentrations were determined in plankton (Buergel, 1983). However, much of the accumulation was due to passive adsorption of aluminium onto the cuticle. Therefore, these BCFs are not representative of the internal concentration of aluminium and overestimate accumulation in these species (ECHA).

Based on the data available, aluminium is considered to have a low bioaccumulation potential to aquatic organisms under circum neutral conditions. In the acidic aquatic environment, aluminium demonstrates a moderate bioaccumulation potential. The high BCFs observed in aquatic invertebrates and high concentration found in planktons is not representative of the internal concentration of aluminium and overestimate accumulation in these species (ECHA).

6 HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

There were no studies available in which the toxicokinetic properties of sodium aluminate were investigated. Thus, information available on supporting substances was taken into account by read-across following a structural analogue approach. Aluminium compounds were considered for this approach, since the pathways leading to toxic outcomes are dominated by the chemistry and biochemistry of the aluminium ion (Al^{3+}) (ECHA)

Following absorption by any route of exposure, aluminium is present in the body as the ionic species (Al_3^+) which is consequently the determining driver regarding the systemic effects of aluminium salts. Sodium aluminate has low acute toxicity by the oral and inhalation routes. It is corrosive to the skin and mucous membranes. However, it is not a skin sensitiser. Systemic effects associated with neurotoxicity have been identified from repeated dose toxicity studies. Sodium aluminate is not genotoxic nor carcinogenic.

B. Toxicokinetics

Adsorption

Following absorption by any route of exposure, aluminium is present in the body as the ionic species (Al_3^+) which is consequently the determining driver regarding the systemic effects of aluminium salts, even including acute toxicity. Hence, it can be assumed that Al_3^+ is the substance of biological interest and that the toxicological effects of sodium aluminate can be attributed exclusively to Al^{3+} (ECHA).

Aluminium is poorly absorbed following oral exposure. Approximately 0.1–0.6 % of ingested aluminium is usually absorbed, depending on the dose. The observed relationship between dose and bioavailability is inconsistent: increased doses of aluminium decreased its bioavailability in some experimental studies while opposite results were observed in other work (NICNAS, 2015).

Excretion

Following oral exposure, unabsorbed aluminium is excreted in the faeces. Absorbed aluminium is excreted principally in the urine and, to a lesser extent, in the bile. It was reported that the higher urinary excretion of aluminium in exposed workers, compared to the general population, demonstrates that some inhaled aluminium can reach the systemic circulation (NICNAS, 2015).

Distribution

Aluminium binds to various ligands in the blood and distributes to every organ, with highest concentrations found in bone and lung tissues. It crosses the brain and placental barriers in very small amounts. Human and animal studies demonstrate accumulation of aluminium in the brain and, in animal studies, in foetuses (ATSDR, 2008 cited in NICNAS, 2015).

Aluminium is efficiently transferred from blood to milk in lactating animals and there is evidence that with increasing age of humans, aluminium concentrations increase in the brain tissue, blood and bone (NICNAS, 2015).

C. Acute Toxicity

In accordance with OECD 401, the oral LD_{50} of read-across substance aluminium oxide in rats is >2,000 mg/kg (ECHA). [Kl. score = 2]

In accordance with OECD 403, the inhalation 4-hour LC_{50} of read-across substance aluminium flake dust in rats is >880 mg/m^3 as aerosol (ECHA). [Kl. score = 1]

D. Irritation

No studies have been conducted since sodium aluminate is corrosive to the skin and mucous membranes (ECHA).

E. Sensitisation

Read-across substance aluminium hydroxide was not a skin sensitiser in a guinea pig maximisation test using the Magnusson and Kligman method (OECD 406 (Skin Sensitisation Test). In the study, guinea pigs were treated with aluminium hydroxide. None of the treated animals showed a positive skin reaction after 24 and 48 hours. No reactions were observed in the control group. The results indicate a sensitisation rate of 0% (0/10), which is below the threshold of 30%. Therefore, aluminium hydroxide was not a sensitising substance (ECHA). [Kl. score = 1]

F. Repeated Dose Toxicity

There are no studies available on the repeated dose toxicity of sodium aluminate by the oral, dermal or inhalation route. Available data on the repeated dose toxicity of other aluminium compounds was taken into account by read-across following a structural analogue approach, since the pathways leading to toxic outcomes are likely to be dominated by the chemistry and biochemistry of the aluminium ion (Al^{3+}) (ECHA).

Oral

In a developmental neurotoxicity and chronic toxicity study similar to OECD guidelines 426 and 452, male and female Sprague-Dawley rats were administered aqueous solutions of aluminium citrate at 3 dosage levels of aluminium citrate 3225 mg/Al citrate/ kg bw/day (300 mg Al/kg bw/day); 1075 mg/Al citrate/kg bw/day (100 mg Al/kg bw/day); 322.5 mg/Al citrate/kg bw/day (30 mg Al/kg bw/day). This study was designed “to develop data on the potential functional and morphological hazards to the nervous system that may arise from pre-and post-natal exposure to aluminium citrate”. The Al citrate and Na-citrate were administered to dams *ad libitum* via drinking water from gestation day 6 until weaning of offspring. Litter sizes were normalized (4 males and 4 females) at postnatal day (PND) 4. Weaned offspring were dosed at the same levels as their dams. Pups were assigned to one of four cohorts (80 males, 80 females): a pre-weaning cohort that was sacrificed at PND 23, and cohorts that were sacrificed at PND 64, PND120 and PND 364.

The results from this study are informative for neurotoxic effects due to combined prenatal and chronic postnatal exposure of rats to high doses of aluminium (30 mg Al/kg bw/day, 100 mg Al/kg bw/day and 300 mg Al/kg bw/day). As the offspring were dosed during the whole post-weaning period, it is difficult to differentiate between developmental or direct toxicity after weaning, however. Urinary tract pathology was observed in rats in the high dose group, more frequently and more severe in the males. The study showed no evidence of an effect of Al-citrate on memory or learning but a more consistent effect was observed in endpoints in the neuromuscular domain. A

NOAEL of 322.5 mg/kg bw/day aluminium citrate was established (equivalent to 30 mg Al/kg bw/day) at the highest dose tested (ECHA). [Kl. score = 1]

Aluminium hydroxychloride was tested in a combined repeated dose toxicity and reproductive/developmental screening toxicity (OECD 422) study. Male and female Wistar rats were dosed by oral gavage with 0, 40, 200, or 1,000 mg/kg aluminium hydroxychloride; these doses correspond to 0, 3.6, 18 or 90 mg/kg-day aluminium. There were no effects in the females at any dose level. In males, there were effects indicative of stomach irritation at the high-dose; no other effects were noted. The NOAEL for systemic effects in this study is 1,000 mg/kg-day, the highest dose tested. The NOAEL for localised effects (site-of-contact) is 200 mg/kg-day (ECHA). [Kl. score = 2]

One long-term chronic oral toxicity study investigated neurodegeneration in aged rats at aluminium levels relevant to total human intake. Thirty Wistar rats (10 per dose) were orally exposed to 0.4 mg, 0.5 mg and 1.7 mg Al/kg bw/day in their food (0.4 mg Al/kg bw/day for all groups) and water (as 0, 2 and 20 ppm Al, equivalent to 0, 0.9 and 11.6 mg AlCl3.6H2O/kg bw/day). Dosing for the rats commenced from 12 months old (equivalent to 35-year-old humans) until the end of their natural life (28 to 37.5 months, equivalent to 82-109 year old humans) and cognitive function was evaluated using the T-maze task. By age 28 months, none of the rats (0/10) in the low Al dose group, two of the rats (2/10) receiving the intermediate Al dose and seven rats (7/10) that consumed Al at the high end of the human range for total dietary Al exhibited significantly lower mean scores on their T-maze task in old age than in middle age, as well as showing dementia-like behaviours such as confusion, inability to focus attention on the task, perseverative activities and incontinence in the T-maze. This study established a no observed effect level (NOEL) of 0.4 mg Al/kg bw/day and LOAEL of 0.5 mg Al/kg bw/day in rats (equivalent to 0 and 0.9 mg AlCl3.6H2O) based on significant cognitive deterioration and neuropathology (brain lesions) (NICNAS, 2015).

In humans, patients with renal failure are at risk of neurotoxicity from aluminium (EHC, 1997 cited in NICNAS, 2014). There is also some epidemiological evidence for long-term cognitive impairment in pre-term infants receiving aluminium-containing nutritional solution intravenously, and associated with occupational exposures (ATSDR, 2008 cited in NICNAS, 2015).

Epidemiological studies have addressed the potential neurotoxicity of aluminium in drinking-water or antacids with mixed results. Some of the drinking-water studies showed an association of aluminium with dementia or Alzheimer's disease, whereas others reported an absence of neuropsychological effects measured in several ways (IPCS, 2012 cited in NICNAS, 2015). Nine out of 13 published epidemiological studies of aluminium in drinking water and Alzheimer's disease have shown statistically significant positive relations (Flatten, 2001 cited in NICNAS, 2015).

Inhalation

No studies were available for sodium aluminate. Due to the corrosive properties of sodium aluminate, human exposure by the inhalation route is unlikely to occur under normal working conditions as it should be avoided by implementation of the corresponding operational conditions and necessary risk management measures (use of PPE). Furthermore, data for particle size distribution provided a MMAD of 115.6 µm for sodium aluminate; only 10 % of the particles are respirable, as the diameter is below 5.132 µm. Therefore, the substance has in general a low exposure potential to the alveolar region of the lung. Conducting inhalation toxicity tests with a low-respirable atmosphere would not produce scientifically meaningful results for systemic toxicity. Instead, most of the inhaled material would presumably intercept in the naso-pharyngeal region and cause adverse local effects there due to the corrosive properties of the substance. Specific systemic

effects after administration by inhalation are not expected, as the respirable fraction of the substance is too low (ECHA).

In a repeated dose study, rats and guinea pigs were exposed to 0.25, 2.5 or 25 mg/m^3 aluminium hydroxychloride as particles aerosol by inhalation for 6 h/day, 5 days/week up to 24 months. Similar groups of animals of both species exposed to clean air served as controls. The tissue deposition pattern of aluminium was determined as well as the effect of aluminium hydroxychloride on body weight gain and organ/body weight ratios. Decreases in body weight were seen in rats exposed to 2.5 and 25 mg/m^3 aluminium hydroxychloride, this was statistically significant at 12 and 24 months. Guinea pig weights were unaffected. This study revealed that after 24 months of exposure of rats and guinea pigs to aluminium hydroxychloride, aluminium is primarily contained in the lungs. The lungs of all rats and guinea pigs exposed to either 2.5 or 25 mg/m^3 of aluminium hydroxychloride contained exposure-related granulomatous reactions characterized by giant vacuoled macrophages containing basophilic material in association with eosinophilic cellular debris. No NOAEC was observed as exposure by inhalation to 0.25, 2.5, or 25 mg/m^3. LOAEC was determined at 0.25 mg/m3 based on significant accumulation of Al_3^+ in the lung (ECHA). [Kl. score=2]

Dermal

No adequate studies are available.

G. Genotoxicity

There are no indications for a genotoxic potential of sodium aluminate based on *in vitro* and *in vivo* studies on read-across substances.

In Vitro Studies

There are no data available on the genotoxic potential of sodium aluminate. The *in vitro* genotoxicity studies on read-across substance aluminium hydroxychloride are presented in Table 3.

Table 3 *In Vitro* Genotoxicity Studies on Aluminium Hydroxychloride

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial reverse mutation (*S. typhimurium* and *E. coli* strains)	-	-	1	ECHA
Mammalian cell gene mutation (mouse lymphoma L5178Y cells)	-	-	1	ECHA
Micronucleus (peripheral human lymphocytes)	-	-	1	ECHA

*+, positive; -, negative

In Vivo Studies

Read-across substance aluminium hydroxide was tested in an OECD Guideline 474 (Mammalian Erythrocyte Micronucleus Test). In the study, aluminium hydroxide did not induce micronuclei in the polychromatic erythrocytes of the bone marrow of male rats treated up to 2000 mg/kg/day (corresponding to 700 mg Al/kg bw/day) (ECHA). [Kl. score = 1]

In an OECD Guideline 475 (Mammalian Bone Marrow Chromosome Aberration Test), single doses of aluminium oxide particulate suspensions were administered to rats by oral gavage. The study results were positive for the nano-sized materials with evidence of a dose-response relationship, while the genotoxicity levels for aluminium oxide bulk material (50 to 200 µm diameter particles) were not statistically significantly different from those for the control. The relevance of the results with nanomaterials for hazard assessment is unclear as the observed effects may have been related to the presence of nanoparticles as foreign bodies in the cells rather than to the chemical properties of the test material itself. Low toxicity, poorly soluble substances, such as aluminium oxide, have produced inflammatory effects *in vitro*, when present as nanoparticles. A particle size dependence of gastrointestinal absorption was apparent. Aluminium oxide levels in the tissues of animals dosed with the larger 50 to 200 µm diameter particles were not elevated to a statistically significant level, consistent with the notion of a low bioavailability of aluminium compounds (ECHA). [Kl. score = 2]

H. Carcinogenicity

No studies are available for sodium aluminate. There is no evidence, that the substance causes carcinogenicity by a direct genotoxic mechanism as this is not indicated by the weight of evidence based on data regarding aluminium containing compounds. Furthermore, in long-term studies with different aluminium compounds, there was no evidence for preneoplastic lesions (ECHA).

I. Reproductive/Developmental Toxicity

In an OECD Guideline 422 (Combined Repeated Dose Toxicity Study with the Reproduction / Developmental Toxicity Screening Test), male and female Wistar rats were dosed by oral gavage with 0, 40, 200, or 1,000 mg/kg aluminium hydroxychloride; these doses correspond to 0, 3.6, 18 or 90 mg/kg-day aluminium. No adverse effects on reproductive behaviour, mating criteria and histological structure of examined reproductive organs during pre-mating, gestation and short-time lactation period were reported. The NOAEL for reproductive toxicity (lack of reproductive /breeding, mating impairment and early postnatal developmental effects) was considered to be 1000 mg aluminium chloride basic/kg bw/day (90 mg Al/kg bw/day). Inflammation of the glandular stomach mucosa was observed at 90 mg Al/kg bw/day (LOAEL local), but not at 18 mg Al/kg bw/day (NOAEL local) or below (ECHA). [Kl. Score = 1]

In a developmental neurotoxicity and chronic toxicity study similar to OECD guidelines 426 and 452, male and female Sprague-Dawley rats were administered aqueous solutions of aluminium citrate at 3 dosage levels of aluminium citrate 3225 mg/Al citrate/ kg bw/day (300 mg Al/kg bw/day); 1075 mg/Al citrate/kg bw/day (100 mg Al/kg bw/day); 322.5 mg/Al citrate/kg bw/day (30 mg Al/kg bw/day). This study was designed “to develop data on the potential functional and morphological hazards to the nervous system that may arise from pre-and post-natal exposure to aluminium citrate”. The Al citrate and Na-citrate were administered to dams *ad libitum* via drinking water from gestation day 6 until weaning of offspring. Litter sizes were normalized (4 males and 4 females) at postnatal day (PND) 4. Weaned offspring were dosed at the same levels as their dams. Pups were assigned to one of four cohorts (80 males, 80 females): a pre-weaning cohort that was sacrificed at PND 23, and cohorts that were sacrificed at PND 64, PND120 and PND 364.

The results from this study are informative for neurotoxic effects due to combined prenatal and chronic postnatal exposure of rats to high doses of aluminium (30 mg Al/kg bw/day, 100 mg Al/kg bw/day and 300 mg Al/kg bw/day). As the offspring were dosed during the whole post-weaning period, it is difficult to differentiate between developmental or direct toxicity after weaning, however. Urinary tract pathology was observed in rats in the high dose group, more frequently and more severe in the males. The study showed no evidence of an effect of Al-citrate on memory or

learning but a more consistent effect was observed in endpoints in the neuromuscular domain. The NOAEL for neurotoxicity was 322.5 mg/kg bw/day of aluminium citrate (equivalent to 30 mg Al/kg bw/day). Furthermore, based on the lack systemic effects in general and of effects on gestational length in particular and the absence of clinical signs in maternal animals, 3225 mg/kg bw/day of aluminium citrate (equivalent to 300 mg Al/kg bw/day) was considered the maternal NOAEL for reproduction toxicity (ECHA). [Kl. Score = 1]

J. Derivation of Toxicological Reference and Drinking Water Guidance Values

The toxicological reference values (TRVs) developed for sodium aluminate follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

TRVs were not derived for sodium aluminate. The Australian drinking water guideline values (ADWG) for aluminium and sodium may be applicable (ADWG, 2011).

ADWG has concluded that there is insufficient data to set a guidance value for aluminium based on health considerations. Based on aesthetic problems caused by post-flocculation, the concentration of acid-soluble aluminium in drinking water should not exceed 0.2 mg/L. Water authorities are strongly encouraged to keep acid-soluble aluminium concentrations as low as possible, preferably below 0.1 mg/L (ADWG, 2011).

The guideline value for sodium in drinking water based on the taste threshold is 180 mg/L. People with severe hypertension or congestive heart failure may need to restrict their overall dietary intake of sodium further if the concentration in drinking water exceeds 20 mg/L (ADWG, 2011).

K. Human Health Hazard Assessment Of Physico-Chemical Properties

Sodium aluminate does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

7 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Due to its chemical nature sodium aluminate is not stable under environmental conditions (pH-values between 4 and 9). The main decomposition products of sodium aluminate in water are 1) sodium hydroxide, 2) aluminium hydroxide and its dehydrate form, aluminium oxide.

The OECD-SIDS SIAR on NaOH states that while the toxicity of the NaOH has been assumed to be related to the hydroxyl anion, in general, a pH change could influence the speciation of other chemicals and therefore, increase and/or decrease toxicity of the substance.

Available data indicate that aluminium salts are relatively non-toxic in most waters with circumneutral pH. Factors that influence aluminium toxicity are consistent with the factors that influence aluminium speciation. These factors include pH, DOC, and water hardness.

Aluminium ions released to surface waters quickly form insoluble aluminium hydroxides in mixing zones. These colloids can sorb to fish gills resulting in asphyxiation and mortality in rare circumstances. Formation of the complex hydroxide causes the aluminium to drop out of solution very rapidly in neutral and alkaline waters. The accumulation of aluminium on fish gills or other organism respiratory membranes may result in physical effects. These conditions however are not typical of most ambient conditions and are more representative of specific mixing zones. The dissolved natural background concentrations of aluminium, in most cases, are at equilibrium therefore an addition of aluminium would lead to the precipitation of aluminium compounds from solution and not result in effects to aquatic life (ECHA).

B. Aquatic Toxicity

Sodium Hydroxide

There are no guideline studies on NaOH, the acute studies summarised below from OECD have Klimisch scores of 3 or 4.

Acute Fish

The 24-hour LC_{50} to *Carassius auratus* (goldfish) is 160 mg/L. At 100 mg/L, which was equivalent to a pH of 9.8, no mortality was observed. The 48-hour LC_{50} to *Leuciscus idus melanotus* is 189 mg/L. The 96-hour LC_{50} of *Gambusia affinis* (mosquitofish) is 125 mg/L. At 84 mg/L, no effects on the fish were observed. The pH was 9 at 100 mg/L.

Acute Invertebrate

The 48-hour LC_{50} is 40 mg/L for *Ceriodaphnia cf. dubia*. The toxicity threshold concentration of NaOH for *Daphnia magna* was reported to range from 40 to 240 mg/L.

Acute Algae

The toxicity of aluminium to *Pseudokirchneriella subcapitata* was tested using sodium aluminate as the source of aluminium. Studies were conducted according to OECD 201. In the study using sodium aluminate, tests were conducted at a single pH of 8 and a water hardness of 10.6 mg/L as CaCO3. The 72-hr EC50 (growth rate) for total and dissolved Al of 1703.8 and 1799 µg/L, respectively, was determined (ECHA). [Kl. Score = 2]

Chronic Fish

No studies were identified for fish. In a non-GLP non-guideline study conducted on rainbow trout for 16 days to read-across substance aluminium chloride AlCl3 at a water hardness of 10 and 100 mg/L as CaCO3 and at pH 7.3 and 8.3, a NOEC was reported for nominal pH 8 at 1.5 mg/L (total Al) and 0.15 mg/L (dissolved Al) (ECHA). [Kl. Score = 2]

Chronic Invertebrate

The toxicity of aluminium to *Pseudokirchneriella subcapitata* was tested using sodium aluminate as the source of aluminium. Studies were conducted according to USEPA 2002, method 1002. In the study using sodium aluminate, tests were conducted at a single pH of 8 and a water hardness of 10.6 mg/L as CaCO3. The 7-day NOEC (growth rate) for total Al of 250 µg/L was determined (ECHA). [Kl. Score = 2]

Chronic Algae

In an OECD 201 Guideline Study conducted on *Pseudokirchneriella subcapitata*, a 72-hr NOEC of 600 µg/L was determined (ECHA). [Kl. Score = 2]

Aluminium Oxide

Data available on aluminium oxide have been generated to demonstrate bioavailability of aluminium in acid water. Adequate studies were found to evaluate the intrinsic toxicity of aluminium oxide. Nonetheless, aluminium oxide is not expected to pose a substantial acute toxicity concern to aquatic receptors (ECHA) [Kl Score =2].

Although aluminium hydroxide, decomposition product of sodium aluminate, showed no toxicity up to its solubility. However, in acidic environment, different aluminium species could be released. Therefore , the toxic effects of dissolved aluminium in aquatic system should be taken in consideration (ECHA).

At pH-values up to 6, acute toxicity ranged from 6 µg/L (*Ceriodaphnia dubia* and algae) to 224 µg/L (fish) for dissolved Al and 7 µg/L (algae) to 10500 µg/L (*Ceriodaphnia dubia*) for total aluminium, excluding the result received under 0 mg/L DOC, because this is not considered to be a standard test condition. Invertebrates, followed by algae appear to be more sensitive than fish. In the single available chronic fish test (60-d) a NOEC of 124 µg/L based on the length is reported (ECHA).

At pH ranges of 6 to 8 (6.3 – 7.8), only data for total Al are available. Acute toxicity was determined from 600 µg/L (algae) to 14000 µg/L (fish). Algae were the most sensitive species. Regarding the chronic toxicity, fish appear to be the most sensitive (NOEC, 60-d, 57 µg/L, based on the number of hatched) (ECHA).

At pH-values above 8, acute and chronic toxicity is within the same range for all three species., LC50/EC50-values in the range of 150 µg/L (algae) – 790 µg/L (fish) were determined for dissolved Al and 317 µg/L (algae) – 7000 µg/L (fish) for total Al. Algae seem to be even more sensitive than daphnids. However, there are fewer data available for invertebrates. Regards the chronic toxicity, the lowest NOEC value of 10 µg/L was determined for *Ceriodaphnia dubia* exposed to unfiltered medium for 7 days. The low endpoint may result from adsorption of aluminium species to the cuticle of test animals. Otherwise, the NOECs were comparable in regard to the acute toxicity, ranging from 400 µg/L (algae and *Ceriodaphnia dubia*) to 14 mg/L (fish) (ECHA).

Resulting from the reported studies algae are most sensitive to aluminium compounds, followed by invertebrates, with acute effect concentrations reported as low as 20 µg/L (ErC_{50}) of dissolved aluminium. In algae, aluminium is considered to interfere with intracellular phosphorus metabolism or glucose metabolism early in the glycolytic pathway (ECHA).

In developing a water quality guideline for aluminium (ANZG, 2018), ANZG[1] separated the screened freshwater toxicity data into those conducted at pH >6.5 and those at pH <6.5. These data are summarised below (it should be noted that only the acute toxicity data was used to derive a water quality guideline).

Freshwater pH >6.5:

Fish

The 48-96 hour LC_{50} values for 5 species were 600 to 106,000 µg/L (the lowest value was for *Salmo salar*). The chronic 8- to 28-day NOEC equivalents[2] from seven species were 34-7,100 µg/L. The lowest measured chronic value was an 8-day LC_{50} for *Micropterus* species of 170 µg/L.

Amphibian

The 96-hour LC_{50} values for *Bufo americanus* were 860-1,660 µg/L. The chronic 8-day LC_{50} for *Bufo americanus* was 2,280 µg/L.

Crustacean

The 48-hour LC_{50} values for one species were 2,300-36,900 µg/L. The chronic 7- to 28-day NOECs were 136-1,720 µg/L.

Algae

The 96-hour EC_{50} values were 460-570 µg/L based on population growth. The NOECs for two species were 800-2,000 µg/L.

Freshwater pH<6.5 (all between pH 4.5 and 6.0):

Fish

The 24-96-hour LC_{50} values for two species were 15-4,200 µg/L (the lowest value was for *Salmo trutta*). The 21- to 42-day LC_{50} values were 15-105 µg/L.

Amphibian

The 96- to 120-day LC_{50} values were 540-2,670 µg/L; the absolute range was 400-5,200 µg/L.

Algae

The NOEC from one species was 2,000 µg/L based on growth.

[1] ANZECC water quality guidelines were revised in 2018 and are now referred to as Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG)

[2] Chronic toxicity values were a mixture of LC/EC_{50} LOEC, MATC, and NOEC values; where stated, these were converted to NOEC equivalents.

C. Terrestrial Toxicity

The relevant compound to consider with regard to terrestrial toxicity of sodium aluminate is aluminium. Aluminium is the most abundant metallic element in the Earth's crust, with a proportion of around 8% by weight, and the third most abundant of all elements. Due to its reactive nature, it does not exist as free elemental metal, rather it occurs in hundreds of different compounds and minerals. Against the background of this abundance and taking into account available data on the anthropogenic input to the terrestrial environment it is reasoned that aluminium from anthropogenic sources is negligible, both in terms of added amounts as well as in terms of toxicity (ECHA).

D. Calculation of PNEC

The PNEC calculations for sodium aluminate follow the methodology discussed in DEWHA (2009).

$PNEC_{water}$

The ANZG water quality guideline (2018) derived a moderate reliability DGV of 55 µg/L for aluminium at pH >6.5 using the statistical distribution method (Burr distribution as modified by SCIRO, Section 8.3.3.3) with 95% protection and an ACR of 8.2. A freshwater low-reliability trigger value of 0.8 µg/L was derived for aluminium at pH of <6.5 using an AF of 20 (essential element) on the low pH trout figure. The low-reliability figures should only be used as indicative interim working levels (ANZG, 2018).

$PNEC_{sediment}$

No experimental toxicity data on sediment organisms are available. Octanol/water partition coefficient (K_{ow}) and organic carbon-water partition coefficient (K_{oc}) parameters do not readily apply to inorganics, such as sodium aluminate. Thus, the equilibrium partitioning method cannot be used to calculate the $PNEC_{sed}$. Based on its properties, no adsorption of sodium aluminate to sediment is to be expected, and the assessment of this compartment will be covered by the aquatic assessment.

$PNEC_{soil}$

Limited experimental toxicity data on soil organisms are available. The environmental distribution of sodium aluminate is dominated by its water solubility. Sorption of aluminium oxide deposits should probably be regarded as a reversible situation, *i.e.*, the substance is not tightly nor permanently bound. K_{oc} and K_{ow} parameters do not readily apply to inorganics, such as sodium aluminate. Thus, the equilibrium partitioning methods cannot be used to calculate the $PNEC_{soil}$. Based on its properties, sodium aluminate is not expected to significantly adsorb to soil, and the assessment of this compartment will be covered by the aquatic assessment.

8 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Sodium aluminate is a strong alkaline substance that dissociates completely in water to sodium (Na^+), aluminium (Al^{3+}) and hydroxyl (OH^-) ions. Biodegradation is not applicable to these inorganic

ions. For the purposes of this PBT assessment, the persistent criteria are not considered applicable to this inorganic salt.

When diluted in the aquatic environment, sodium aluminate is hydrolysed rapidly to form insoluble aluminium hydroxide and free sodium ions. Sodium is an essential element for all living organisms. Thus, bioaccumulation in organisms is not relevant for sodium ions. Based on the data available, aluminium is considered to have a low bioaccumulation potential to aquatic organisms under circum neutral conditions. Thus, sodium aluminate is not expected to bioaccumulate and does not meet the screening criteria for bioaccumulation.

The lowest chronic NOEC value in fish, invertebrates and algae for aluminium is <0.1 mg/L; thus, the dissolved aluminium from sodium aluminate meets the screening criteria for toxicity.

The overall conclusion is that sodium aluminate is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for sodium aluminate.

9 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Sodium Aluminate	1302-42-7	Not a PBT	No	No	NA	No	No	Yes	3	3	2

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 2 - Hazard Assessment and Qualitative Assessment Only. Develop toxicological profile and PNECs for water and soil and provide qualitative discussion of risk.
Toxicity based on dissolved aluminium in acidic conditions which overestimates risk for sodium aluminate. Lower toxicity is expected in environmentally relevant conditions.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

10 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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A. Abbreviations and Acronyms

°C	degrees Celsius
ADWG	Australian Drinking Water Guidelines
AICIS	Australian Industrial Chemicals Introduction Scheme
AICS	Australian Inventory of Chemical Substances
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines
BCF	bioconcentration factor
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DEWHA	Department of the Environment, Water, Heritage and the Arts
EC_{50}	median effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/cm^3	grams per cubic centimetre
g/L	grams per litre
IUPAC	International Union of Pure and Applied Chemistry
KI	Klimisch scoring system
kPa	kilopascal
L/kg	litres per kilogram
LC_{50}	lethal concentration 50%
LD_{50}	lethal dose 50%
LOEC	lowest observed effective concentration
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
mL	millilitre
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
OECD	Organisation for Economic Co-operation and Development
PBT	Persistent, Bioaccumulative and Toxic
PNEC	Predicted No Effect Concentration
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
µg/L	micrograms per litre

SODIUM CARBOXYMETHYLCELLULOSE
HYDROXYETHYL CELLULOSE

This dossier on sodium carboxymethylcellulose and hydroxyethyl cellulose presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. It does not represent an exhaustive or critical review of all available data. Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Sodium carboxymethylcellulose and hydroxyethyl cellulose are classified as **tier 1** chemicals and require a hazard assessment only.

1 BACKGROUND

Sodium carboxymethylcellulose (Na CMC) is a white or slightly yellowish powder. Sodium carboxymethylcellulose, one of major cellulosic ethers, is widely used as a binding, thickening and stabilising agent.

Hydroxyethyl cellulose is a white, odorless and tasteless powder. It is used a polysaccharide derivative with gel thickening, emulsifying, bubble-forming, water-retaining and stabilizing properties.

Sodium carboxymethylcellulose and hydroxyethyl cellulose are biodegradable, but are not considered to be readily biodegradable. They are not expected to bioaccumulate.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): sodium;2,3,4,5,6-pentahydroxyhexanal;acetate

CAS RN: 9004-32-4

Molecular formula: $C_8H_{15}NaO_8$

Molecular weight : 262 g/mol (for monosubstituted structural unit); variable 21,000 g/mol – 500,000 g/mol (for macromolecules)

Synonyms: Sodium carboxymethylcellulose, Carboxymethylcellulose, sodium; cellulose, carboxymethyl ether, sodium salt; sodium CMC; sodium cellulose glycolate; sodium CMC; Na CMC

Chemical Name (IUPAC): 1-[[3,4,5-tris(2-hydroxypropoxy)-6-[4,5,6-tris(2-hydroxypropoxy)-2-(2-hydroxypropoxymethyl)oxan-3-yl]oxyoxan-2-yl]methoxy]propan-2-ol

CAS RN: 9004-62-0

Molecular formula: $C_{36}H_{70}O_{19}$ (monomer); $C_2H_6O_2$.xUnspecified (polymer)

Molecular weight : 806.9 g/mol (monomer); variable for the polymer

Synonyms: hydroxyethyl cellulose; cellulose, 2-hydroxyethyl ether

3 PHYSICO-CHEMICAL PROPERTIES

Sodium carboxymethylcellulose is a white or slightly yellowish, almost odourless and tasteless hydroscopic powder, consisting of very fine particles, fine granules or fine fibres (WHO, 1967).

Sodium carboxymethylcellulose, one of major cellulosic ethers, is widely used as a binding, thickening and stabilising agent (Lee et al. 2018).

Pharmaceutical grades of sodium carboxymethylcellulose are available commercially at degree of substitution (DS) values of 0.7, 0.9, and 1.2, with a corresponding sodium content of 6.5%–12% wt. It is also available in several different viscosity grades. Sodium carboxymethylcellulose is highly soluble in water at all temperatures, forming clear solutions. Its solubility depends on its degree of substitution (Düring et al, 2019).

Hydroxyethyl cellulose is a white, odorless and tasteless powder. It is used a polysaccharide derivative with gel thickening, emulsifying, bubble-forming, water-retaining and stabilizing properties. It is very soluble in water with a density of 1,033 kg/m^3 (NCBI, 2026).

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 1). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for sodium carboxymethylcellulose or hydroxyethyl cellulose.

NICNAS has assessed sodium carboxymethylcellulose and hydroxyethyl cellulose in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that they pose no unreasonable risk to human health or the environment.[1][2]

Based on an assessment of environmental hazards, NICNAS has also identified hydroxyethyl cellulose as a chemical of low concern to human health and the environment (NICNAS, 2017 and DoEE, 2017a). Chemicals of low concern are unlikely to have adverse environmental effects if they are released to the environment from coal seam gas operations.

Table 1 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No

[1] https://www.industrialchemicals.gov.au/chemical-information/search-assessments?assessmentcasnumber=9004-32-4

[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=066e433e-f36b-1410-8de4-00e8f2afc108

Convention, Protocol or Other International Control	Listed Yes or No?
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Sodium carboxymethylcellulose and hydroxyethyl cellulose are biodegradable, but are not considered to be readily biodegradable. They are not expected to bioaccumulate.

B. Partitioning

Polymers in this group are expected to be water soluble. If discharged into natural waters, sodium carboxymethylcellulose is expected to be present as a polyanion as a result of the ionisation of the carboxymethyl substituents. Comparatively, complex partitioning behaviour in aquatic systems may occur based on the well-established interactions between colloids and carboxymethylcellulose, which is a key part of the function of this polymer in laundry detergents (de Oude 1992).

C. Biodegradation

In an OECD 301A test, sodium carboxymethylcellulose (DS 0.7) showed 25% biodegradation after 28 days, followed by a much slower increase of the biodegradation percentage. At day 110, 58% of the theoretical oxygen demand (ThOD) was consumed, leading the investigators to conclude that there was complete degradation of sodium carboxymethylcellulose (VanGinkel and Gayton, 1996). Therefore, sodium carboxymethylcellulose is degradable, but not readily biodegradable [Kl. score = 1].

In an OECD 302A test, only 50% of the carbon from sodium carboxymethylcellulose (DS 0.7) was removed (VanGinkel and Gayton, 1996).

Other studies have also shown partial degradation of sodium carboxymethylcellulose in ready and inherent biodegradability tests (reviewed in VanGinkel and Gayton, 1996) [Kl. score = 4].

Cellulose gums are generally slowly biodegraded (NCBI, 2026).

If a chemical is found to be inherently or readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017b).

D. Environmental Distribution

No experimental partition coefficient data are available for sodium carboxymethylcellulose or hydroxyethyl cellulose. Based on their high water solubility, the substances are likely to be mobile in the environment.

E. Bioaccumulation

Sodium carboxymethylcellulose is a water-soluble semisynthetic polymer with a high molecular weight (approximately 21,000 to 500,000 Daltons). Due to its large molecular weight, it is not expected to bioaccumulate.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Sodium carboxymethylcellulose and hydroxyethyl cellulose are of a low concern for toxicity to aquatic organisms.

B. Aquatic Toxicity

Acute Studies

Table 2 lists the results of acute aquatic toxicity studies conducted on sodium carboxymethylcellulose. No data was available for hydroxyethyl cellulose.

Table 2 Acute Aquatic Toxicity Studies on Sodium Carboxymethylcellulose or Sodium Carboxymethylcellulose

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Brachydanio rerio	96-hour LC_{50}	>2,500*	1	VanGinkel and Gayton (1996)
Daphnia magna	48-hour EC_{50}	>5,000*	1	VanGinkel and Gayton (1996)
Daphnia magna	48-hour EC_{50}	87.26**	2	Warne and Schifko (1999)
Selenastrum capricornutum	96-hour EC_{50}	500*	1	VanGinkel and Gayton (1996)

*sodium carboxymethylcellulose (0.7) was tested.
** sodium carboxymethylcellulose was tested.

Additional aquatic toxicity studies on sodium carboxymethylcellulose by Schöberl *et al.* (1988) reported LC_{50} values of >250 to 1,000 mg/L for fish and >1,000 mg/L for *Daphnia*.

VanGinkel and Gayton (1996) also tested the degradation products of sodium carboxymethylcellulose from *Agrobaceterium* CM-1 in acute toxicity studies. There was no toxicity to *Brachydanio rerio* (1,000 mg/L), *Daphnia magna* (1,000 mg/L) or *Selenastrum capricornutum* (500 mg/L).

It is unclear why there is a large difference in *Daphnia* EC_{50} values between the studies of VanGinkel and Gayton (1996) and Warne and Schifko (1999). One possibility is that the two laboratories may have tested different sodium carboxymethylcellulose products. VanGinkel and Gayton (1996) tested sodium carboxymethylcellulose (0.7), whereas Warne and Schifko (1999) tested a nondescript sodium carboxymethylcellulose in their study. However, the studies by Schöberl et al. (1988) reported an acute toxicity for *Daphnia* that is similar to that reported by VanGinkel and Gayton (1996). As a water-soluble polymer, sodium carboxymethylcellulose would be expected to exhibit low toxicity due to its large molecular weight and its inert characteristics.

Chronic Studies

No additional studies were identified. However, VanGinkel and Gayton (1996) reported that there was no toxicity to *Daphnia* in a 21-day reproduction test when tested using effluent from sodium carboxymethylcellulose treated within a conventional activated sludge system (CAS system), (*i.e.*, no toxicity due to partial degradation of sodium carboxymethylcellulose).

C. Terrestrial Toxicity

No studies are available.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Sodium carboxymethylcellulose and hydroxyethyl cellulose are water-soluble semisynthetic polymers that are not readily biodegradable. Therefore, they meet the screening criteria for persistence.

Sodium carboxymethylcellulose is a water-soluble semisynthetic polymer that has a high molecular weight (approximately 21,000 to 500,000 Daltons), which limits its bioavailability to aquatic organisms. Hydroxyethyl cellulose is expected to behave similarly. Therefore, they are not expected to bioaccumulate and do not meet the screening criteria for bioaccumulation.

The acute EC_{50} of sodium carboxymethylcellulose is >1 mg/L in fish, invertebrates and algae. Therefore, sodium carboxymethylcellulose and by read-across hydroxyethyl cellulose do not meet the screening criteria for toxicity.

The overall conclusion is that sodium carboxymethylcellulose and hydroxyethyl cellulose are not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for sodium carboxymethylcellulose or hydroxyethyl cellulose.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Sodium Carboxymethylcellulose	9004-32-4	Not a PBT	No	No	Yes	No	No	No	1	1	1
Hydroxyethyl cellulose	904-62-0	Not a PBT	No	No	Yes	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

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B. Abbreviations and Acronyms

AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
CAS system	conventional activated sludge system
CMC	carboxymethylcellulose
COC	constituent of concern
DoEE	Department of the Environment and Energy
DS	degree of substitution
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
IChEMS	Industrial Chemicals Environmental Management Standard
IMAP	Inventory Multi-tiered Assessment and Prioritisation
IUPAC	International Union of Pure and Applied Chemistry
Kl	Klimisch scoring system
LC	lethal concentration
mg/L	milligrams per litre
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
OECD	Organisation for Economic Co-operation and Development
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
ThOD	theoretical oxygen demand
WHO	World Health Organisation

SODIUM DICYCLOHEXYL SULFOSUCCINATE

This dossier on sodium dicyclohexyl sulfosuccinate presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): sodium 1,4-bis(cyclohexyloxy)-1,4-dioxobutane-2-sulfonate

CAS RN: 23386-52-9

Molecular formula: $C_{16}H_{25}NaO_7S$

Molecular weight: 384.42 g/mol

Synonyms: sodium dicyclohexyl sulfosuccinate; butanedioic acid, sulfo-, 1,4-dicyclohexyl ester, sodium salt; sodium 1,4-dicyclohexyl sulphonatosuccinate; sodium 1,4-dicyclohexyloxy-1,4-dioxobutane-2-sulfonate; bis-cyclohexyl sodium sulfosuccinate

SMILES: [Na+].[O-]S(=O)(=O)C(CC(=O)OC1CCCCC1)C(=O)OC1CCCCC1

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of sodium dicyclohexyl sulfosuccinate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	White solid particulate/powder	2	ECHA
Melting Point	200°C @ 101.3 kPa	1	ECHA
Boiling Point	270°C @ 101.3 kPa	1	ECHA
Density	1269 kg/m^3@ 20°C	1	ECHA
Vapour Pressure	0.041 Pa @ 20°C	2	ECHA
Partition Coefficient (log K_{ow})	-1.504 @ 20°C	1	ECHA
Water Solubility	74.15 g/L @ 20°C	1	ECHA
Flash Point	Study technically not feasible	-	ECHA
Auto flammability	400°C	1	ECHA
Viscosity	Not applicable, substance is a solid	-	ECHA
Henry's Law Constant	0.00004 Pa m^3/mol (temperature not provided)	-	USEPA, 2026

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Sodium dicyclohexyl sulfosuccinate is inherently biodegradable and has a low potential for bioaccumulation. It is not expected to adsorb to soil or sediment.

B. Biodegradation

The substance was tested for ready biodegradability, inherent biodegradability and enhanced ready biodegradability under OECD 301 and OECD 302 test designs. Based on the results of the tests performed, the substance is not readily biodegradable, but inherently biodegradable (not fulfilling specific criteria). In the key studies for ready and inherent biodegradability, the substance exhibited a significant amount of mineralization, i.e., 49% on average during 28 days in an OECD 301 B study and more than 70% during 10 days in an OECD in a 302 B study, respectively. At the end of the incubation period of OECD 301 studies (day 28), the plateau phases were not reached. Results of enhanced OECD 301 studies show repeatedly, that more than 60% of the substance was ultimately degraded within 60 days of incubation. Hence, the substance is not persistent in the environment based on enhanced biodegradation testing under OECD 301 enhanced design (ECHA). [KI Score = 1].

If a chemical is found to be readily or inherently biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

The soil organic carbon partition coefficient (K_{oc}) was estimated using the KOCWIN™ v2.00 module of EPI Suite™ v.4.11. KOCWIN™. The resulting value is 84.61 L/kg, which corresponds to a Log K_{oc} of 1.93. (ECHA). [KI Score = 2].

If released to soil, based on this K_{oc} value, the substance is expected to not strongly adsorb to soil and be mobile. If released to water, based on this K_{oc} value and the water solubility, the substance has low potential for adsorption to suspended solids and sediments and will likely partition to the water column.

D. Bioaccumulation

An experimental study with a structurally similar source substance (CAS 577-11-7) resulted in a bioconcentration factor (BCF) of 9.33 L/kg in carp (4.1% lipid content). Based on this value, it was concluded that bioaccumulation of the substance is of no concern (ECHA). [KI Score = 2].

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

The absorption, excretion and metabolism of sodium dicyclohexyl sulfosuccinate have been investigated. The compound was well absorbed, metabolized and excreted after oral administration (two thirds were observed in the 24 hours urine; one third was found in the feces). Sodium dicyclohexyl sulfosuccinate has a low potential for acute oral and dermal toxicity. It is a skin and eye irritant but not a skin sensitiser. Repeated exposure by the oral route in rats showed no adverse effects. Sodium dicyclohexyl sulfosuccinate is not considered a reproductive or developmental toxicant and does not have genotoxicity or mutagenicity potential.

B. Metabolism

The absorption, excretion and metabolism of sodium dicyclohexyl sulfosuccinate have been investigated. Unlabelled DSS and radiolabelled compound (carbon-14) were used. Using a gas chromatographic procedure, a similarity in percent excretion of dose into urine was observed in rats dosed orally and intravenously, indicating a high degree of absorption of the oral dose. Confirmation of extensive absorption of DSS was obtained through oral dosage of 10 mg/kg carbon-14 labelled compound. Two thirds of the administered radioactivity was found in the urine at 24 hours after dosage. All of the activity was in the form of metabolites (2-ethylhexanol forming compounds). No bioaccumulation potential based on study results. The compound was well absorbed, metabolized and excreted after oral administration (two thirds were observed in the 24 hours urine; one third was found in the feces) (ECHA). [Kl. Score=2]

C. Acute Toxicity

Oral

Oral acute toxicity (OECD 401) was tested in 5 male albino Wistar rats with a 20% w/v aqueous dispersion of sodium dicyclohexyl sulfosuccinate (80% purity) at 1250, 2500, 5000, and 10000 mg /kg bw. In the 10000 and 5000 mg/kg bw dose group, all 5 animals died within 6 hours after dosing. In the 2500 and 1250 mg/kg bw dose group, all animals survived the 14 days observation period. In all dose groups, signs of intoxication were observed (diarrhea, lethargy, prostration, comatose) and gross autopsy of the survivors was normal. The LD_{50} was calculated to be 3540 mg/kg; taking into account that the product contained 80% active ingredient LD 50 is corresponding to 2830 mg active ingredient/kg bw (ECHA). [Kl. Score=2]

Dermal

Acute dermal toxicity (OECD 402) was tested in 10 male albino rabbits under covered application to the clipped skin of 5.0 g sodium dicyclohexyl sulfosuccinate (80% active). There was one mortality at day 6 and weakness of the hind legs was seen in one animal. The survivors showed no gross pathology at autopsy. There was a severe erythema and severe edema followed by eschar formation. Dermal LD_{50} was >5000 mg/kg bw, taking into account that the product contained 80% active ingredient, the LD_{50} corresponds with >4000 mg active ingredient/kg bw (ECHA). [Kl. Score=2]

Inhalation

No data available

D. Irritation

Skin

A skin irritation study was conducted in accordance with OECD 404 guidelines. Six rabbits underwent a covered application to the clipped intact and abraded skin of 0.5 g sodium dicyclohexyl sulfosuccinate as an aqueous paste containing 80% active ingredient. Scoring according to Draize et al. (1944) demonstrated a primary irritation score of 2.3. It was concluded that the test item produces some irritation of rabbit skin. This material is not expected to produce significant skin irritation under conditions of ordinary industrial handling. However, based on the primary irritation score of 2.3 and erythema still present at 72 hours, the product is considered irritating (ECHA). [Kl. Score=2]

Eye

An eye irritation study was conducted in accordance with OECD 405 guidelines. 0.1 g sodium dicyclohexyl sulfosuccinate containing 80% active ingredient was introduced into the conjunctival sac of 6 rabbits. Scoring according to Draize after 24, 48 and 72 hours demonstrated a mean cornea score of 17.6/80, a mean iris score of 5/10 and a mean conjunctivae score of 14/20. At the readings made at 24, 48 and 72 hours, there was discernible opacity or ulceration of the cornea other than a slight dulling of the normal lustre, inflammation of the iris other than slight deepening of the folds, or slight circumcorneal injection, diffuse, deep-crimson red appearance of the conjunctivae, with individual vessels not easily discernible and obvious swelling of the conjunctivae, excluding cornea and iris, with partial eversion of the lids. It was concluded that the test item produces irritation of rabbit eyes (ECHA). [Kl. Score=2]

E. Sensitisation

The potential for skin sensitisation was studied using the Human Repeat Insult Patch Test (HRIPT). Approximately 300 mg of the sodium dicyclohexyl sulfosuccinate, >90% pure (2.5% in petrolatum) was applied to patch sites on the backs or volar forearms of 100 subjects for ten alternate-day 24-hour periods under occlusion. Following a seven-day rest period, challenge patches of the test item (1.0% in petrolatum) were applied in the same manner to fresh sites on the backs or volar forearms of all 100 subjects for 24 hours. Challenge sites were read on removal of the patch and 24 hours thereafter. There were no instances of irritation or sensitisation from this test item. It is unlikely that this test item would present a danger of irritation or sensitisation in normal, intended use.(ECHA). [Kl. Score=2]

F. Repeated Dose Toxicity

Oral

In an Oral Repeated Dose Toxicity study (OECD 408), read-across substance sodium dihexyl sulfosuccinate (CAS RN 2373-38-8), administered at constant concentrations in pelleted diet for 90 consecutive days to male and female Wistar rats 10/sex/dose) at 100, 300, or 1000 mg/kg bw/day. The examinations included clinical signs, mortality, body weight / body weight gain, food consumption, ophthalmoscopy, neurological assessment (including FOB and locomotor activity assessment), vaginal smears, clinical pathology (including haematology, coagulation, urinalysis), thyroid hormone analysis, gross pathology, sperm analysis, organ weights and histopathology. Full histopathology was performed in Groups 1 (Control) and 4 (High dose). Furthermore, any organs or tissues with macroscopic abnormalities (except minor changes) were subjected to histological examination from all groups. Immunohistochemistry evaluation (specific for alpha 2u-microglobulin) was carried out for all Control and High dose males. A short transient reduction in food intake was seen in High dose males and females on Day 1-4, with a normal food intake for High dose females for the study duration, and normal intake for males up to Day 46, but a significantly lower intake after the increase in dietary concentration. The low food intake in High dose males after Day 46 caused a reduced body weight and weight gain, with a Day 90 body weight 7.6% below control. The High dose level was considered to be the maximum achievable intake by the dietary route in males (because increasing the dietary concentration, reduced the food intake significantly). No test item effect was noted in the ophthalmology evaluation or neurological assessment. No test item related adverse effect was seen in clinical pathology. In conclusion, under the conditions of this 90-day repeated dose toxicity study, the following no observed adverse effect level (NOAEL) values for the read-across substance in Wistar rats were 826 mg/kg bw/day in males, 915 mg/kg bw/day in females and 870.5 mg/kg bw/day for both sexes. (ECHA). [Kl. Score=1]

Inhalation

No data available

Dermal

No data available

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on sodium dicyclohexyl sulfosuccinate are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on INSERT NAME

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial Reverse Mutation Assay (OECD 471)	-	-	1	ECHA
In Vitro Mammalian Cell Gene Mutation Test (OECD 476)	-	-	1	ECHA
In Vitro Mammalian Cell Micronucleus Test	-	-	1	ECHA

*+, positive; -, negative

In Vivo Studies

No data available

H. Carcinogenicity

Oral

No data available

Inhalation

No data available

Dermal

No data available

I. Reproductive Toxicity

In a Combined Repeated Dose Toxicity Study with the Reproduction / Developmental Toxicity Screening Test (OECD 422), sodium dicyclohexyl sulfosuccinate was administered daily by oral gavage to Wistar (Crl:WI) rats at 3 dose levels (100, 300, or 1000 mg/kg bw/day). Male and female Wistar rats were treated for 2 weeks pre-mating and then during the mating/post-mating periods. This was 28 days in total for males. Females were treated throughout gestation and up to and including postpartum/lactation day (PPD) 13.

Parameters measured during the study included signs of morbidity and mortality twice daily, daily general and/or weekly detailed observation of clinical signs, weekly body weight and food consumption, and clinical pathology evaluation (including hematology, coagulation, clinical chemistry and urinalysis). Neurological assessments, including a functional observation battery (FOB) and measurements of the landing foot splay, grip strength and motor activity were performed during the last week of the treatment. In addition, the reproductive performance, pregnancy, parturition and postpartum/lactation period were monitored in the adult animals, and viability, clinical signs and development were evaluated in their F1 offspring until post-natal day (PND13). At termination, necropsy with macroscopic examination was performed. Weights of selected organs were recorded, and representative tissues/organs were sampled and preserved in appropriate fixatives from the adult animals and/or offspring. The thyroxine (T4) levels in the Day 13 (PPD13) pups and adult males were also assessed. For the adult animals, a detailed histological examination was performed on the selected list of retained organs in the Control and High dose groups.

In summary, under the conditions of this study the daily administration of sodium dicyclohexyl sulfosuccinate by oral gavage to Wistar rats at dose levels of 100, 300 or 1000 / 600 mg solid/kg bw/day (Low, Mid and High dose groups, respectively) did result in test item related mortality and clinical signs at 1000 mg/kg bw/day. The initial High dose level of 1000 mg solid/kg bw/day was reduced to 600 mg solid/kg bw/day at 4 weeks due to adverse clinical effects (local irritation) and mortality. The bodyweight, body weight gain, and food consumption of the test item treated groups did not show any test item related effect. At the functional observation battery (FOB) and locomotor activity measurement, there were no test item related changes in animal behaviour, general physical condition, grip strength, motor activity, or in the reactions to different type of stimuli in the control or test groups. No adverse test item-related findings were seen in the clinical pathology parameters. No test item effect on oestrus cycle of parental females was noted. No test item related changes were noted in the reproductive parameters during mating and gestation, delivery and post-partum/lactation period until PPD14. There were no adverse effects on the F1 offspring viability, clinical signs, physical or sexual development. No test item related to macroscopic finding was recorded for F1 pups at necropsy. No test item related macroscopic or microscopic changes were recorded at necropsy or at histopathology evaluation of routine organs/tissues or in any reproductive organs. Under the experimental conditions of this study and based on the results of thyroid hormone measurement, thyroid weights, nipple retention, anogenital distance and external reproductive organs analysis, histopathology and reproductive performance, there was no evidence for any endocrine effects. The NOAEL for local toxicity of the parental generation: 300 mg solid/kg bw/day (based on noisy/laboured respiration at 600 mg solid/kg bw/day). The NOAEL for systemic toxicity of the parental generation was considered to be >=600 mg solid/kg bw/day. The NOAEL for reproductive effects of the parental generation was considered to be >=600 mg solid/kg bw/day. The NOAEL for pup development and survival was considered to be >=600 mg solid/kg bw/day (ECHA). [Kl. Score=1]

J. Developmental Toxicity

Oral

In a developmental toxicity study (OECD 414), pregnant dams (Hannover Wistar rats) were treated daily by dietary administration of sodium dicyclohexyl sulfosuccinate, from Gestation Day (GD) 6 up to and including Gestation Day (GD) 20, where sperm positive day was counted as day 0 of pregnancy (GD 0). Control dams were treated with control diet, while the other dams received diets consisting of 1500, 3900, or 13,000 ppm of Sodium Dihexyl Sulfosuccinate. Parameters monitored during the study included mortality and clinical observations, body weight, body weight gain and individual food consumption. Maternal reproductive parameters associated with uterine examination were evaluated, and the foetuses were weighed (anogenital distance was also

determined) and examined for external, visceral and skeletal abnormalities. Placentas were examined macroscopically. Weights of selected organs of dams were recorded, and representative tissues/organs were sampled and preserved in appropriate fixatives from the adult animals. The triiodothyronine (T3), thyroxine (T4) and thyroid stimulating hormone (TSH) levels of dams were also determined. There was no test item-related mortality in the study. Nevertheless, clinical signs such as hunched back (2/24) and piloerection (3/24) observed in the High dose group were considered to be related to the test item treatment and the test item related effect in the death of one High dose female (numbers) cannot be excluded. No test item effect was noted on body weight and food consumption/conversion parameters. No test item related macroscopic findings were observed at necropsy in the study animals. There were no effects on organ weight of dams. There were no test item-related macroscopic findings or microscopic changes in the thyroid/parathyroid glands of dams. There was no test item effect on the measured thyroid hormone concentrations (T3, T4 and TSH). No effect on the intrauterine parameters were observed in the test item treated animals when compared to the controls. Placenta was normal in all cases. No test item related effect was noted on foetal weight or number of runts. No test item related effect was identified on anogenital distance. Most of the external, visceral and skeletal findings of foetuses corresponded with the current historical control or study control data or have isolated occurrence or were without dose response; thus, they were considered incidental ascribed to individual variability and not related to treatment. In case of interrupted ribs (or costal cartilage), statistically significantly increased incidence was observed in the Low dose group when compared to the Control group or the historical control data, but there was no dose response and the incidence in the High dose group was similar to the Control level. Based on these data, the observed values were considered not related to the test item treatment. The following NOAEL values were derived: NOAEL maternal toxicity: 3900 ppm (336.8 mg/kg bw/day); NOAEL embryotoxicity: 13000 ppm (990.7 mg/kg bw/day); NOAEL foetotoxicity: 13000 ppm (990.7 mg/kg bw/day); NOAEL teratogenicity: 13000 ppm (990.7 mg/kg bw/day) (ECHA). [Kl. Score=1]

Inhalation

No data available

Dermal

No data available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for sodium dicyclohexyl sulfosuccinate follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

The lowest NOAEL from these studies is 300 mg/kg bw/day based on local toxicity of the parental generation in a Combined Repeated Dose Toxicity Study with the Reproduction / Developmental Toxicity Screening Test conducted on rats. The NOAEL of 300 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 300/(10 x 10 x 1 x 10 x 1) = 300/1000 =0.3 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.3 x 70 x 0.1)/2 = 1.05 mg/L

B. Cancer

There was no data available to assess the carcinogenic potential of sodium dicyclohexyl sulfosuccinate. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Sodium dicyclohexyl sulfosuccinate does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Sodium dicyclohexyl sulfosuccinate is expected to have low acute and chronic toxicity to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on sodium dicyclohexyl sulfosuccinate.

Table 3: Acute Aquatic Toxicity Studies on Sodium Dicyclohexyl Sulfosuccinate

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Lepomis macrochiru (Bluegill sunfish)	96-hr LC_{50}	451.2	2	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	439 a.i.	1	ECHA
Desmodesmus subspicatus (Green alga)	72-hr EC_{50}	903	1	ECHA

Note: a.i. = active ingredient

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on sodium dicyclohexyl sulfosuccinate.

Table 4: Chronic Aquatic Toxicity Studies on Sodium Dicyclohexyl Sulfosuccinate

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Pimephales promelas (Fathead minnow fish)	33-day NOEC	10.7 a.i.	1	ECHA
Daphnia magna (Water flea)	21-day EC_{10}	> 14.6 a.i.	1	ECHA
Desmodesmus subspicatus (Green alga)	72-hr EC_{10}	903 a.i.	1	ECHA

Note: a.i. = active ingredient

C. Terrestrial Toxicity

No studies are available. The registered substance is an ionic substance, has a log Pow of < 3 and is inherently biodegradable. Accumulation in soil organisms and persistence in soil compartment are therefore very unlikely (ECHA).

D. Calculation of PNEC

The PNEC calculations for sodium dicyclohexyl sulfosuccinate follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (451.2 mg/L), invertebrates (439 mg/L), and algae (903 mg/L). NOEC values from long-term studies are available for fish (10.7 mg/L), invertebrates (>14.6 mg/L) and algae (903 mg/L). On the basis that the data consists of short-term and long-term results from three trophic levels, an assessment factor of 10 has been applied to the lowest reported NOEC of 10.7 mg/L for fish. The $PNEC_{water}$ is 1.07 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 2.03 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (2.425/1280) \times 1000 \times 1.07$
$= 2.027$ mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 3.3844/1000 \times 2400]$
$= 2.425\ m^3/m^3$

Where:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
$= 84.61 \times 0.04$
$= 3.3844$ L/kg

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for sodium dicyclohexyl sulfosuccinate calculated from EPISUITE™ using the MCI is 84.61 L/kg.
F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are no toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 1.21 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
$= (1.6922/1500) \times 1000 \times 1.07$
$= 1.207$ mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)

BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
$Kp_{soil} = K_{oc} \times f_{oc}$
= 84.61 x 0.02
= 1.6922 m^3/m^3

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for sodium dicyclohexyl sulfosuccinate calculated from EPISUITE™ using the MCI is 84.61 L/kg.
F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Sodium dicyclohexyl sulfosuccinate is inherently biodegradable and thus does not meet the screening criteria for persistence.

Based on a log K_{ow} value of -1.504 and a measured BCF in fish of 9.33 L/kg, the potential for bioaccumulation is low. Thus, sodium dicyclohexyl sulfosuccinate does not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on sodium dicyclohexyl sulfosuccinate are > 0.1 mg/L. The acute $E(L)C_{50}$ values from the acute aquatic toxicity studies on sodium dicyclohexyl sulfosuccinate are > 1 mg/L. Thus, sodium dicyclohexyl sulfosuccinate does not meet the criteria for toxicity.

The overall conclusion is that sodium dicyclohexyl sulfosuccinate is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Skin Irritation Category 2

Eye Damage Category 1

B. Labelling

Danger

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

Rinse immediately with plenty of running water (for 10 minutes), seek medical attention from a specialist.

Skin Contact

Rinse with running water and soap. Apply replenishing cream. Change all contaminated clothing. r.

Inhalation

None.

Ingestion

Rinse the mouth. Drink 1-2 glasses of water.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam.

Specific Exposure Hazards

In case of fire, keep containers cool with water spray.

Special Protective Equipment for Firefighters

Wear respiratory protection equipment according to ambient air conditions.

C. Accidental Release Measures

Personal Precautions

Avoid contact with skin and eyes. Wear protective equipment..

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

Remove mechanically. Collection and delivery to recycling enterprise or other registered elimination institution. Wash away residue with plenty of water. .

D. Storage And Handling

General Handling

Keep product and empty container away from open flames and sources of ignition. In case of fire, cool container with jet of water.

Storage

Keep container tightly sealed and store in a frost free place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard for sodium dicyclohexyl sulfosuccinate has not been established in Australia.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Suitable breathing mask when there is inadequate ventilation.

Hand Protection:

Suitable are protective gloves with the following specification. The recommendation is valid for laboratory conditions, specific workplace conditions must be taken into consideration separately. Recommended protective gloves: Vitoject/ viton / 0,7mm / Level 6 > 480 min.

Skin Protection: Suitable protective clothing.

Eye protection: Protective goggles.

Other Precautions: Avoid skin and eye contact. Keep away from food, beverages and animal feed.

F. Transport Information

Sodium dicyclohexyl sulfosuccinate is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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U.S. Environmental Protection Agency. Comptox Chemicals Dashboard. https://comptox.epa.gov/dashboard/chemical/details/DTXSID8027826 (accessed July 12, 2026) Dicyclohexyl sodium sulfosuccinate

SODIUM DODECYL DIPHENYL ETHER DISULFONATE

This dossier on sodium dodecyl diphenyl ether disulfonate presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): Benzene, 1,1'-oxybis-, tetratpropylene derivs., sulfonated, sodium salts

CAS RN: 119345-04-9

Molecular formula: $C_{24}H_{34}NaO_7S_2$

Molecular weight: 521.6423 g/mol

Synonyms: sodium dodecyl diphenyl ether disulfonate; benzene, 1,1'-oxybis-, tetrapropylene derivs., sulfonated, sodium salt; diphenyl ether tetrapropylene derivs. sulfonated sodium salts

SMILES: C1(S(=O)(=O)OCCCCCCCCCCCC)=CC=C(OC2C=CC(S([O-])(=O)=O)=CC=2)C=C1.[Na+]

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of sodium dodecyl diphenyl ether disulfonate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Solid white powder. Manufactured in an aqueous solution.	2	ECHA
Melting Point	250°C @ 101.3 kPa	2	ECHA
Boiling Point	Substance decomposed prior to melting and boiling. No boiling temperature available	2	ECHA
Density	972 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	0 Pa @ 20°C	2	ECHA
Partition Coefficient (log K_{ow})	-2.68 @ 20°C	2	ECHA
Water Solubility	1000 g/L @ 20°C	2	ECHA
Flash Point	Not feasible for this substance.	-	ECHA
Auto flammability	Substance is not self-ignitable	2	ECHA
Viscosity	Not feasible for a solid substance	-	ECHA
Henry's Law Constant	1.01 x 10^{-5} Pa-m^3/mole @ 20°C	2	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Sodium dodecyl diphenyl ether disulfonate is not readily biodegradable. It is expected to strongly adsorb to soil or sediment. It is not expected to bioaccumulate.

B. Biodegradation

Sodium dodecyl diphenyl ether disulfonate is not readily biodegradable. In an activated sludge study under aerobic conditions, there was 58% degradation after 28 days, as determined by loss of dissolved organic carbon, which suggests persistence in water (ECHA) [KI. Score = 1].

A supplied OECD TG 309 test on simulated mineralisation of the assessed chemical in water, showed a total recovery of 92.1 – 97.8%, in 28 days, indicating little mineralisation of the assessed chemical and a half-life greater than 60 days.

If a chemical is found to be not readily or inherently biodegradable, it is categorised as Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

Based on a log soil organic carbon partition coefficient (K_{oc}) of 4.54-4.81 L/kg, sodium dodecyl diphenyl ether disulfonate is expected to have high potential to adsorb to soil and will hardly be mobile (AICIS, 2024).

D. Bioaccumulation

Based on a log K_{ow} of -2.68, sodium dodecyl diphenyl ether disulfonate has low potential for bioaccumulation (ECHA). This is supported by a low estimated BCF range of 2.3 to 3.3 L/kg (ECHA; AICIS, 2024) and BCF of < 14 L/kg (ECHA). [Kl. Score = 1]

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Sodium dodecyl diphenyl ether disulfonate is metabolized to monoalkyl disulfate (MADS) and monohydroxylated metabolites of monoalkyl monosulfate (MAMS) in human liver microsomal incubations. This material has a low potential for acute oral and dermal toxicity. Sodium dodecyl diphenyl ether disulfonate is minimally irritating to the skin and corrosive to the eyes. The material is a not a skin sensitiser. In chronic studies, this substance demonstrated the potential for adverse reproductive effects. It is not carcinogenic or genotoxic.

B. Metabolism

An *in vitro* study investigated the metabolism of radio-labelled sodium dodecyl diphenyl ether disulfonate. Based on the proposed structures of the two most abundant components, MAMS and MADS were identified in both human and rat liver microsomal incubations while dihydroxylated metabolites of MAMS were detected only in human liver microsomal incubations (ECHA) [Kl. Score=1].

C. Acute Toxicity

Oral

In the acute oral toxicity test, three female Fischer 344 rats received 2000 mg/kg of the neat sodium dodecyl diphenyl ether disulfonate by single-dose oral gavage. Clinical signs indicative of systemic toxicity in the 2000 mg/kg dose level consisted of faecal and urine soiling, salivation, chromorhinorrhea, decreased activity, and thin appearance. The clinical signs were first observed two hours post dose and persisted through test day four. While one of these rats initially lost weight, all animals gained weight over the two-week observation period. The estimated acute oral LD50 for female Fischer 344 rats was greater than 2000 mg/kg (ECHA) [Kl. Score=2].

Inhalation

No data available

Dermal

A single application of 2000 mg/kg of sodium dodecyl diphenyl ether disulfonate was applied to the clipped trunks of two male New Zealand White rabbits under an impervious, occlusive bandage. Erythema, oedema and burns were observed, at the application site, immediately after removing the wrap. Due to the fact that, in the previous skin irritation test, five consecutive daily applications of this test material to an intact site, and three to a slightly abraded site (minor incision through the stratum corneum of insufficient depth to produce bleeding), caused only very slight irritation to the skin, it is felt that these burns may be a result of the procedure used in preparing the animals for testing. These observations were noted through test day four in one animal, and test day eight in the other. By test day eight, both animals were observed with scaling which persisted through the end of the study. Administration of the test material at 2000 mg/kg had no apparent effect on body weight during the two-week observation period. The estimated acute dermal LD50 for male New Zealand White rabbits was greater than 2000 mg/kg (ECHA) [Kl. Score=2].

D. Irritation

Skin

In a skin irritation test, topical applications of 0.1 ml of neat sodium dodecyl diphenyl ether disulfonate to the ear, and 0.5 ml to intact and abraded skin on the abdomen of a male New Zealand White (NZW) rabbit was conducted. Five consecutive daily doses of the test material were applied to the intact abdominal skin, and the apex of the left pinna, and three consecutive daily applications to the abraded abdominal site. No irritation was observed on the ear. Very slight erythema was observed at the intact site after the last application. Very slight erythema was observed at the abraded site on test day two through test day five. The study was terminated 72 hours after the final dose. Based on the outcomes on the intact ear and abdomen rabbit skin, it was concluded that the test material has only minimal skin irritation potential (ECHA) [Kl. Score=2].

Eye

Single samples of 0.1 ml of sodium dodecyl diphenyl ether disulfonate were instilled into one eye of each of three rabbits. Observations were made 1, 24, 48 and 72 hours and 7, 14 and/or 21 days after instillation. Exposure resulted in effects on the cornea, iris and conjunctivae. Corneal injury was seen as opacity (maximum grade 1 or 2) and epithelial damage (maximum 90% of the corneal area). As a

result of the corneal injury, pannus (neovascularisation of the cornea) was apparent 7 or 14 days after instillation in two animals. The corneal injury had resolved within 14 or 21 days and persisted in one animal until termination. Iridial irritation (grade 1) was observed which had completely resolved within 24 hours or 7 days. Irritation of the conjunctivae was seen as redness, chemosis and discharge, which had completely resolved within 14 or 21 days in two animals and persisted in one animal until termination. Reduced flexibility of the eyelids was observed in one animal after 48 and 72 hours. Based on the degree and persistence of the corneal injury as seen in one animal, it was concluded that ocular corrosion had occurred (ECHA) [Kl. Score=1].

E. Sensitisation

A skin sensitisation study was conducted in accordance with OECD 406 guidelines. Ten test and five control female Dunkin-Hartley guinea pigs were administered intradermal injections (0.1 ml per site) of sodium dodecyl diphenyl ether disulfonate (0.5% wlv in water), with and without Freund's Complete Adjuvant, and a control with Adjuvant alone. After one week, the scapular area between the two intradermal injection sites (one day before the topical treatment the skin was rubbed with 10 % (w/v) sodium dodecyl sulfate to increase sensitivity) was treated topically for 48 hours with 0.5 ml of a 50% (w/v) dilution of the test material in water. Induction readings were made at day 3 (after intradermal injection) and day 10 (after epidermal exposure). Challenge on day 22 consisted of a single, 24-hour, topical application (0.5 ml) of the test material at concentrations of 20 and 50% w/v in water on two separate sites on the right flank of each test and control animal under an occlusive dressing. Observations for any dermal reaction were made approximately 24 and 48 hours after removal of the dressing. A rechallenge was conducted approximately one week after the first challenge with 5 and 10 % (wlv) of the test material. During the induction phase, severe erythema was noted at all intradermal injection sites treated with Adjuvant and test material including signs of necrosis with three animals. Well defined to moderate erythema was observed in most cases of the epidermally treated induction sites of the experimental animals. Between the controls and the experimental animals there was no significant difference noted at the challenge sites 24 and 48 hours after removal of the dressings with corresponding test material concentrations of 5, 10, 20, and 50 %. Thus, the test material is not a skin sensitiser (ECHA) [Kl. Score=1].

F. Repeated Dose Toxicity

Oral

In a chronic oral toxicity study, male and female beagle hounds were maintained for two years on diets containing 0.5, 0.25, or 0.125% of sodium dodecyl diphenyl ether disulfonate (equivalent to 128, 65, and 34 mg/kg/day) without evidence of adverse effect as judged by general appearance and behaviour, growth, food consumption, haematological values, determinations of serum urea nitrogen content, alkaline phosphatase and transaminase activity and bromsulfophthalein dye retention, final organ and body weights, and gross and microscopic examination of the tissues compared to control animals. At the highest dose level (1% or 319 mg/kg/day, study LOAEL), growth was retarded in the male and female dogs. These dogs also had loose stools and diarrhea for the first 45 days of the experiment; slightly increased alkaline phosphatase activity in both male dogs and in two out of four female dogs; variations in a few organ/body weight ratios with no difference in organ weights when considered on the absolute basis in grams. Haematological determinations, serum urea nitrogen and transaminase values, determination of bromsulfophthalein dye retention, and gross and microscopic examination of the tissues gave no indication of adverse effects when compared with the controls. Based on these effects, the systemic NOEL in Beagle dogs was determined to be 0.5% or 128 mg/kg bw/day sodium dodecyl diphenyl ether disulfonate (ECHA) [Kl. Score=1].

In a non-guideline repeat dose oral toxicity study, sodium dodecyl diphenyl ether disulfonate was administered to rats (strain not specified) (n = 30/sex/group) via diet over a two-year period at concentrations of 15, 50, 150, and 500 mg/kg bw/day. No clinical signs of toxicity, difference in food consumption, mortality or changes in haematology/coagulation parameters, organ weights, and gross and microscopic examination of the tissues were observed throughout the treatment period at all tested concentrations of the assessed chemical. At 24 months, the average body weight of females in the 500 mg/kg bw/day group was significantly lower than in the control group of the same sex (194 g average body weight for the 500 mg/kg bw/day group; 240 g for the control group). The male rats in this group showed a slighter, statistically insignificant growth retardation (351 g average body weight for the 500 mg/kg bw/day group; 364 g for the control group). Under the conditions of this study, the NOAEL in female rats was established as 150 mg/kg bw/day (ECHA). [Kl. Score = 2]

Inhalation

No data available

Dermal

No data available

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on sodium dodecyl diphenyl ether disulfonate are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on Sodium dodecyl diphenyl ether disulfonate

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay)	-	-	1	ECHA
OECD Guideline 476 (In Vitro Mammalian Cell Gene Mutation Test)	-	-	1	ECHA
OECD Guideline 473 (In Vitro Mammalian Chromosome Aberration Test)	-	-	1	ECHA

*+, positive; -, negative

In Vivo Studies

No data available

H. Carcinogenicity

Oral

In a chronic toxicity study, groups of male and female rats were maintained for a period of two years on diets containing 1.0, 0.3, 0.1, or 0.03% of sodium dodecyl diphenyl ether disulfonate without evidence of adverse effect as judged by general appearance and behavior, mortality, incidence of

tumorous growths, food consumption, hematological studies, serum urea nitrogen and alkaline phosphatase determinations, bone marrow examination, final average body and organ weights, and gross and microscopic examination of the tissues. On a body weight basis, the test substance was consumed in the amounts of 500, 150, 50, or 15 mg./kg/day by the rats on these levels. The only evidence of any adverse effect whatsoever was seen in the rats which received 1.0 percent (500 mg./kg bw /day). Growth was depressed in the group of female rats on this level, with a statistically significant decrease in the final average body weight at the end of two years. The group of male rats showed a slighter, statistically insignificant growth retardation. The systemic NOEL was determined to be 150 mg/kg bw/day in the diet. NOAEL for carcinogenicity was > 1% in the diet or 500 mg/kg bw/day. (ECHA) [Kl. Score=1].

Inhalation

No data available

Dermal

No data available

I. Reproductive Toxicity

A Reproduction / Developmental Toxicity Screening Test was conducted in accordance with OECD 421 guidelines. Male and female rats were exposed to sodium dodecyl diphenyl ether disulfonate continuously via the diet. Males were exposed for 14 days prior to mating and continuing through the day of euthanasia (for a minimum of 56 days). Females were exposed for 14 days prior to mating and continuing throughout mating, gestation, and lactation until euthanasia (Lactation Day 21). F1 offspring were potentially exposed in utero and through nursing during lactation. Offspring selected to constitute the F1 generation were directly exposed beginning at weaning (Postnatal Day [PND] 21) and continuing until euthanasia (PND 35). Dietary test substance concentrations were adjusted based on historical control food consumption and body weight data for lactating females in order to compensate for the higher caloric demands of milk production. Dietary test substance concentrations were also adjusted for F1 pups beginning on PND 21, based on historical control food consumption and body weight data for age-matched animals in order to compensate for rapid growth rates and higher food efficiency during this period. In conclusion, a concentration of 7500 ppm (equivalent to 446 to 506 mg/kg/day for males and females) was considered to be the no-observed-adverse-effect level (NOAEL) for F0 reproductive toxicity of sodium dodecyl diphenyl ether disulfonate when administered continually in the diet to Crl:CD(SD) rats. The NOAEL for F0 systemic toxicity was 3500 ppm (equivalent to 193 to 258 mg/kg/day for males and females), based on effects on body weight for F0 males and females at 7500 ppm and excessive toxicity (early group termination) noted at 15,000 ppm. The NOAEL for F1 neonatal toxicity was unable to be determined based on the lower numbers of pups born and lower postnatal survival from birth to PND 4 in both treated groups (3500 and 7500 ppm); some of these effects were driven by a single dam/group and need to be followed up in the definitive OECD 443 study. Based on the lack of any evidence of toxicity, the NOAEL for F1 systemic toxicity was considered to be 7500 ppm (equivalent to 427 and 483 mg/kg/day for males and females, respectively) (ECHA) [Kl. Score=1].

J. Developmental Toxicity

Oral

In a Prenatal Developmental Toxicity Study (OECD 414), the objectives of this study were to determine whether the test substance, Sodium dodecyl diphenyl ether disulfonate, could affect

rabbit development after maternal dietary exposure. Rabbit does were exposed to sodium dodecyl diphenyl ether disulfonate continuously via the diet during Gestation Days 7–29. The following parameters and end points were evaluated in this study: mortality, clinical signs, body weights, body weight gains, gravid uterine weights, food consumption, food utilization, organ weights, macroscopic examinations, intrauterine growth and survival, and fetal morphology. Based on the presence of maternal toxicity at 4000 ppm, including a lower mean body weight gain with corresponding reduced mean food consumption when the overall exposure period was evaluated, a dietary level of 1500 ppm, equivalent to 56 mg/kg/day, was considered to the be the no-observed-effect level (NOEL) for maternal toxicity when sodium dodecyl diphenyl ether disulfonate was administered orally in the diet to time-mated New Zealand White rabbits. Based on the lower fetal body weights at 4000 ppm, a dietary level of 1500 ppm was also considered to the NOEL for embryo/fetal development (ECHA) [Kl. Score=1].

Inhalation

No data available

Dermal

No data available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for sodium dodecyl diphenyl ether disulfonate follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

The lowest NOAEL from these studies is 128 mg/kg bw/day based on a two-year chronic oral toxicity study conducted in beagle dogs. This NOAEL was similar to the NOAEL of 150 mg/kg bw/day based on a two-year chronic oral study in rats. The NOAEL of 128 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

- UF_A (interspecies variability) = 10
- UF_H (intraspecies variability) = 10
- UF_L (LOAEL to NOAEL) = 1
- UF_{Sub} (subchronic to chronic) = 1
- UF_D (database uncertainty) = 1
- Oral RfD = 128 / (10 x 10 x 1 x 1 x 1) = 128 / 100 = 1.28 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (1.28 x 70 x 0.1)/2 = 4.48 mg/L

B. Cancer

Sodium dodecyl diphenyl ether disulfonate does not have carcinogenic potential. Thus, a cancer reference value was not derived

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Sodium dodecyl diphenyl ether disulfonate does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Sodium dodecyl diphenyl ether disulfonate is expected to have moderate acute toxicity to aquatic organisms and low chronic toxicity to aquatic organisms. It is expected to have low chronic toxicity to terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on sodium dodecyl diphenyl ether disulfonate.

Table 3: Acute Aquatic Toxicity Studies on Sodium Dodecyl Diphenyl Ether Disulfonate

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Pimephales promelas (Fathead minnow fish)	96-hr LC_{50}	1.3	1	ECHA; AICIS, 2024
Daphnia magna	48-hr LC_{50}	1.64	2	ECHA; AICIS, 2024
Raphidocelis subcapitata (formerly Selenastrum capricornutum) (Green algae)	96-hr EC_{50}	840 (growth)[a]	1	ECHA
Raphidocelis subcapitata (Green algae)	72-hr EC_{50}	15,939 (growth)	-	AICIS, 2024

a - Read-across: dodecyl (sulfophenoxy) benzenesulfonic acid, disodium salt [CAS# 028519-02-0] and oxybis (dodecylbenzenesulfonic acid) disodium salt [CAS# 025167-32-2]

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on sodium dodecyl diphenyl ether disulfonate.

Table 4: Chronic Aquatic Toxicity Studies on Sodium Dodecyl Diphenyl Ether Disulfonate

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Pimephales promelas (Fathead minnow fish)	33-day NOEC	0.15	1	ECHA; AICIS, 2024
Daphnia magna	21-day NOEC	1	1	ECHA
Selenastrum capricornutum (Green algae)	96-hr NOEC	298[a]	1	ECHA; AICIS, 2024

a - (Read-across: dodecyl (sulfophenoxy) benzenesulfonic acid, disodium salt [CAS# 028519-02-0] and oxybis (dodecylbenzenesulfonic acid) disodium salt [CAS# 025167-32-2, 47% max])

C. Terrestrial Toxicity

In an eight-week study with *Eisenia fetida* (earthworm) in artificial soil composed of sand, kaolin clay, and sphagnum peat, an EC_{50} of >1,000 mg/kg dw and NOEC of 566 mg/kg dw was identified based on reproduction (ECHA) [Kl. Score = 1] (AICIS, 2024). In another study with earthworms, a 28-day NOEC of 1,000 mg/kg dw was identified (AICIS, 2024).

D. Calculation of PNEC

The PNEC calculations for sodium dodecyl diphenyl ether disulfonate follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute $E(L)C_{50}$ values are available for fish (1.3 mg/L), invertebrates (0.58 mg/L), and algae (840 mg/L). NOEC values from long-term studies are available for fish (0.15 mg/L), invertebrates (1 mg/L) and algae (298 mg/L). On the basis that the data consists of short-term and long-term results from three trophic levels, an assessment factor of 10 has been applied to the lowest reported NOEC of 0.15 mg/L for fish. The $PNEC_{water}$ is 0.015 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 7.8 mg/kg sediment wet weight.

The calculations are as follows:

$$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$$
$$= (667/1280) \times 1000 \times 0.015$$
$$= 7.81 \text{ mg/kg}$$

Where:

$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water}$ = 0.8 + [(0.2 x Kp_{sed})/1000 x BD_{solid}]
= 0.8 + [(0.2 x 1389/1000 x 2400]
= 667 m^3/m^3

Where:

Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
Kp_{sed} = K_{oc} x f_{oc}
= 34,674 x 0.04
= 1,389 L/kg

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for sodium dodecyl diphenyl ether disulfonate is 34,674 L/Kg.
F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are limited toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 6.9 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil}$ = (Kp_{soil}/BD_{soil}) x 1000 x $PNEC_{water}$
= (693/1500) x 1000 x 0.015
= 6.93 mg/kg

Where:

Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
Kp_{soil} = K_{oc} x f_{oc}
= 34,674 x 0.02
= 693 m^3/m^3

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for sodium dodecyl diphenyl ether disulfonate is 34,674 L/kg.
F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Sodium dodecyl diphenyl ether disulfonate is not readily biodegradable and thus does meet the screening criteria for persistence.

The measured BCF in fish is <14 L/Kg. Thus, sodium dodecyl diphenyl ether disulfonate does not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on sodium dodecyl diphenyl ether disulfonate are > 0.1 mg/L. The acute E(L)C_{50} values from the acute aquatic toxicity studies on sodium dodecyl diphenyl ether disulfonate are > 1 mg/L. Thus, sodium dodecyl diphenyl ether disulfonate does not meet the criteria for toxicity.

The overall conclusion is that sodium dodecyl diphenyl ether disulfonate is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Repr. Category 2, H361fd

Eye Dam. Category 1, H318

Aquatic Chronic Category 2, H411

B. Labelling

Danger

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

Workplace exposure standards are not available for sodium dodecyl diphenyl ether disulfonate in Australia.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Sodium dodecyl diphenyl ether disulfonate is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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SODIUM FLUOROESCEIN

This dossier on sodium fluoroescein presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): disodium 3-oxo-3H-spiro[2-benzofuran-1,9'-xanthene]-3',6'-diolate

CAS RN: 518-47-8

Molecular formula: $C_{20}H_{12}O_5.2Na$

Molecular weight: 376.27 g/mol

Synonyms: sodium fluoroescein; fluorescein sodium; disodium_2-(3-oxo-6-oxidoxanthen-9-yl)benzoate; spiro[isobenzofuran-1(3H),9'-[9H]xanthen]-3-one, 3',6'-dihydroxy-, disodium salt

SMILES: [Na+].[Na+].[O-]c1ccc2c(Oc3cc([O-])ccc3C24OC(=O)c5ccccc45)c1

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of Sodium fluoroescein

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Solid dark red crystalline powder	1	ECHA
Melting Point	313°C @ 101.3 kPa	1	ECHA
Boiling Point	Study technically not feasible	-	ECHA
Density	579 kg/m^3@ 20°C	1	ECHA
Vapour Pressure	213.316 Pa @ 25°C	2	ECHA
Partition Coefficient (log K_{ow})	0.34 (temperature not provided)	2	ECHA
Water Solubility	Very soluble (>10 g/L) @ 20°C	2	ECHA
Flash Point	217.6°C	1	ECHA
Auto flammability	300°C	2	ECHA
Viscosity	Study scientifically not necessary	-	ECHA
Henry's Law Constant	0.207 Pa m^3/mol (temperature not provided)	-	USEPA, 2026

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Sodium fluoroescein is not readily biodegradable, has a low potential to bioaccumulate. It is not expected to adsorb soil, suspended solids or sediment.

B. Biodegradation

A combination of two biodegradation tests (Closed Bottle test and Manometric Respiratory test, OECDs 301 D, F) was carried out to investigate the biodegradability of sodium fluoroescein. Closed Bottle Test was performed according to the guidelines of OECD 301D. This test is characterized by low bacteria density (102–105 colony forming units (CFUs)/mL), low nutrient content, and constant temperature (20 ± 1 °C) and it was kept in the dark. The average percentage biodegradation value after 28 days by oxygen concentration was found to be 7.6%. In an OECD Guideline 301 F (Ready Biodegradability: Manometric Respirometry Test), 0.1% degradation was observed after 28 days. Based on the results obtained, sodium fluoroescein is expected to be not readily biodegradable (ECHA). [KI Score = 2]

If a chemical is found to be not readily or inherently biodegradable, it is categorised as Persistent since its half-life is substantially greater than 60 days (DoEE, 2017).

C. Environmental Distribution

The soil organic carbon partition coefficient (K_{oc}) value of sodium fluoroescein in soil was determined to be 88.81 L/Kg (ECHA). [Kl. Score = 2]. Based on this value, if released to soil, the substance is expected to have limited adsorption to soil and be mobile. If released to water, based on its solubility, it is also not expected to adsorb to suspended solids or sediment.

D. Bioaccumulation

A bioconcentration factor (BCF) of < 0.27 L/kg was determined in fish (Cyprinus carpio) indicating a low potential for bioconcentration or bioaccumulation (ECHA). [Kl. Score = 2].

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Sodium fluorescein has a low acute oral toxicity potential, non-irritating to the skin and mild to moderately irritating to the eyes. Human exposure demonstrated that sodium fluorescein is not a sensitiser. Repeated Dose Toxicity studies demonstrated that sodium fluorescein has toxic potential at higher doses but was not a reproductive or developmental toxicant. There were mixed genotoxicity results depending on the model.

B. Metabolism

Available toxicokinetic studies of the read-across substance fluorescein (CAS RN 2321-07-5) in humans are through the intravenous route. Following administration, fluorescein is rapidly distributed throughout the body. The chemical binds to albumin and red blood cells reversibly and yellowish discolouration of the skin occurs within a few minutes of injection, which fades over 24 hours. Notably, fluorescein distributes to retinal tissues and the central artery of the eye within 7 to 14 seconds (NICNAS, 2018).

Fluorescein is metabolised rapidly into fluorescein monoglucuronide (~80 % in plasma converted to the conjugate after a 1-hour period). When the plasma was measured in a fluorophotometer, fluorescein monoglucuronide was observed to have 1/4–1/3 of the fluorescence intensity of fluorescein and has a half-life of approximately 264 minutes compared with fluorescein at 23.5 minutes. Therefore, the glucuronide conjugate contributes to almost all plasma fluorescence after 4–5 hours (NICNAS, 2018).

Fluorescein and its metabolites are mainly eliminated via renal excretion. Following administration, the urine remains slightly fluorescent for 24–36 hours. Systemic clearance of fluorescein is completed by 48–72 hours at a dose of 500 mg. When used in nursing mothers, fluorescein has been demonstrated to be excreted in human milk for up to 4 days (NICNAS, 2018).

C. Acute Toxicity

Oral

An acute oral LD_{50} of 6,720 mg/kg bw in rats and 4,740 mg/kg bw in mice has been reported for sodium fluorescein (ECHA). [Kl. Score = 2]

Dermal

No data are available

Inhalation

No data are available

D. Irritation

Skin

Sodium fluorescein is reported to be non-irritating in a study conducted on mammals. No other details are available (ECHA). [Kl. Score = 2] This is supported by Quantitative Structure-Activity Relationships (QSAR) predictions using OECD toolbox version 3.3 on New Zealand White rabbits (ECHA). [Kl. Score = 2]

Eye

In an eye staining study, sodium fluorescein (0.1 mL at a 2 % aqueous solution) was instilled in the lower conjunctival sac of each eye of 4 groups of New Zealand White rabbits (n = 3/sex/group). The duration of exposure was 15 sec, 30 sec, 1 minute or 4 minutes, daily for 10 days over 2 weeks. The treated eyes were flushed out with saline solution. The eyes were scored based on the degree of staining of the eye, and the mean irritation score over all 4 timepoints was 1–2 (slight to moderate). Effects were reversible within 48 hours. The chemical was stated to be mild to moderately irritating (ECHA). [Kl. Score 2]

Cultured corneal endothelial cells of New Zealand white rabbits were exposed for 1 minute to various concentrations of fluorescein sodium. The degree of cell damage was determined by in vitro staining with trypan blue and comparison with results in a control group. Structural changes in corneal endothelial cells after dye exposure were evaluated by light microscopy and transmission electron microscopy (TEM). Sodium fluorescein at 10% did not induce significant damage to corneal

endothelial cells. On TEM, corneal endothelial cells that had been exposed to 10% sodium fluorescein appeared to be safe as determined by no cytotoxic effects on rabbit corneal endothelial cells in culture. (NCBI, 2026)

E. Sensitisation

There was no information available on the sensitisation potential of sodium fluorescein in animals.

In a patch test study conducted on 16 patients, only 1 positive reaction was reported following application of the chemical at 1 % concentration in petrolatum. Sodium fluorescein can be considered as a non- sensitiser in humans (ECHA). [Kl. Score = 2]

F. Repeated Dose Toxicity

Oral

In a 14-day combined repeat dose and reproductive/developmental toxicity study (OECD test guideline (TG) 422), female Sprague-Dawley rats (n=25/dose) were administered sodium fluorescein at 0, 100, 500 and 1500 mg/kg bw/day by oral gavage. Mortality and discolouration of small intestines were observed at the highest dose, as well as discolouration of urine and amniotic fluid at dose levels of 100 mg/kg bw and above. A No Observed Adverse Effect Level (NOAEL) of 500 mg/kg bw/day was established (ECHA). [Kl. Score = 2]

In a 14-day repeat dose oral toxicity study (OECD TG 422), Dutch belted female rabbits (n=14/dose) were administered sodium fluorescein at 0, 30, 100 and 250 mg/kg bw/day by oral gavage. There was one mortality in each of the 30, 250 mg/kg bw/day and control groups. Pneumonia was observed in all three rabbits following necropsy. No effects were observed on body weight, body weight gain and gross pathology compared to the control. Therefore, the NOAEL was considered to be 250 mg/kg bw/day for sodium fluorescein in this study (ECHA). [Kl. Score = 2]

Inhalation

No data are available

Dermal

No data are available

G. Genotoxicity

Based on the available information sodium fluorescein is not expected to be genotoxic.

In Vitro Studies

The *in vitro* genotoxicity studies on sodium fluorescein are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on Sodium Fluorescein

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
bacterial reverse mutation assay S. typhimurium, other: TA 1538, TA98, TA1537, TA1535, and TA100	-	-	2	ECHA
Chromosome aberration (mammalian cells and CHO cells)	-	-	2	ECHA
mammalian cell gene mutation assay (L5178Y mouse lymphoma cells)	+	-	2	ECHA

*+, positive; -, negative

In Vivo Studies

No data are available.

H. Carcinogenicity

Oral

No data are available.

Inhalation

No data are available.

Dermal

No data are available.

I. Reproductive Toxicity

In a one-generation reproductive toxicity study (OECD TG 421), a group of New Zealand White female rabbits were administered sodium fluorescein at 2240 mg/kg bw/day intravenously at 10 % in aqueous solution at days 5, 6, 8, 13, 15 and 16 after copulation. No effects on oestrous cycles, birth defects, soft tissues, visceral abnormalities or pathological changes were observed throughout the experiment. One stillbirth occurred but all other offspring were normal. A total of 14 offspring from 4 mothers died at week 4, this was attributed to poor health of the mothers and not to the treatment. The NOAEL was considered to be 2240 mg/kg bw/day for F0 and F1 generations (ECHA). [Kl. Score = 2]

In a combined reproductive and developmental toxicity study (OECD TG 421) a group of Sprague Dawley female rats (n=25/group) were administered sodium fluorescein by oral gavage at 0, 100, 500 or 1500 mg/kg bw for 14 days. When treated with 1500 mg/kg bw/day 6 rats died. No significant effects on reproduction and development were observed on body weight, number of litters, foetal sex ratio, post-implantation loss/dam, total implantations/dam and corpora lutea/dam. The NOAEL was considered to be 1500 mg/kg bw/day for F0 and F1 generations (ECHA). [Kl. Score = 2]

J. Developmental Toxicity

Oral

In a teratogenic potential study, Sprague-Dawley Female rats were treated with sodium fluorescein in the concentration of 0, 100, 500 and 1500mg/kg body weight orally by gavage. Six rats died at 1500 mg/kg bw as compared to control. Orange discoloration of the urine was observed in 100, 500 and 1500 mg/kg bw treated rats and Slight decrease in body weight gain were observed in 1500 mg/kg bw treated rats as compared to control. Green discoloration of the amniotic fluid was observed in 1, 10 and 16 rats in the 100, 500 and 1500 mg/kg/day treated rats as compared to control. But, no effect on dams with viable foetuses, viable foetuses/dam, post-implantation loss, total implantations, corpora lutea and number of litters with malformations were examined in treated rats as compared to control. In addition, no significant effect on foetal sex ratio, foetal body weight, gross pathology and histopathology were observed. Therefore, the NOAEL was considered to be 1500 mg/kg bw (ECHA). [Kl. Score = 2]

Inhalation

No data are available

Dermal

No data are available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for sodium fluorescein follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

The lowest NOAEL from these studies is 250 mg/kg bw/day based on a short-term repeat dose oral toxicity study in rabbits. The NOAEL of 250 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 250/(10 x 10 x 1 x 10 x 1) = 250/1000 = 0.25 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.25 x 70 x 0.1)/2 = 0.875 mg/L

B. Cancer

There was no data available for the carcinogenic potential of sodium fluorescein. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Sodium Fluorescein does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Sodium fluoroescein is expected to have low acute and chronic toxicity to aquatic organisms. No studies are available for terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on sodium fluoroescein.

Table 3: Acute Aquatic Toxicity Studies on Sodium Fluoroescein

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Oncorhynchus mykiss(Rainbow trout)	96-hr LC_{50}	1,372	2	ECHA
Ictalurus punctatus (Channel catfish)	96-hr LC_{50}	2,267	2	ECHA
Lepomis macrochirus (Bluegill)	96-hr LC_{50}	3,433	2	ECHA

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Daphnia pulex (Water flea)	48-hr EC_{50}	337	2	ECHA
Chlorella vulgaris(Green alga)	72-hr EC_{50}	209.24 (growth)	1	ECHA

Chronic Studies

No relevant studies are available.

C. Terrestrial Toxicity

No studies are available.

D. Calculation of PNEC

The PNEC calculations for sodium fluoroescein follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (1,372 mg/L), invertebrates (337 mg/L), and algae (209.24 mg/L). No chronic studies are available. On the basis that the data consists of short-term results from three trophic levels, an assessment factor of 1000 has been applied to the lowest reported E(L)C_{50} value of 209.24 mg/L for algae. The $PNEC_{water}$ is 0.21 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 0.41mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (2.505/1280) \times 1000 \times 0.21$
$= 0.41$ mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 3.5524/1000 \times 2400]$
$= 2.505\ m^3/m^3$

Where:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
$= 88.81 \times 0.04$
$= 3.5524$ L/kg

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for sodium fluoroescein is 88.81 L/kg.

F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are no toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 0.25 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$

$= (1.7762/1500) \times 1000 \times 0.21$

$= 0.25$ mg/kg

Where:

Kp_{soil} = soil-water partition coefficient (m^3/m^3)

BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]

$Kp_{soil} = K_{oc} \times f_{oc}$

$= 88.81 \times 0.02$

$= 1.7762\ m^3/m^3$

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for sodium fluoroescein is 88.81 L/kg.

F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Sodium fluoroescein is not readily biodegradable; thus, it meets the screening criteria for persistence.

Based on a log K_{ow} of 0.34 and a measured BCF of < 0.27 L/kg, sodium fluoroescein does not meet the criteria for bioaccumulation.

No chronic aquatic toxicity data is available for sodium fluoroescein. The acute $E(L)C_{50}$ values are > 1 mg/L. Thus, sodium fluoroescein does not meet the criteria for toxicity.

The overall conclusion is that sodium fluoroescein is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Not classified

B. Labelling

No signal word.

C. Pictogram

Not applicable.

X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

Rinse opened eye for several minutes under running water.

Skin Contact

Immediately wash with water and soap and rinse thoroughly.

Inhalation

Supply fresh air; seek medical attention. .

Ingestion

If symptoms persist consult doctor.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide or powder. Fight larger fires with water spray or alcohol resistant foam.

Specific Exposure Hazards

Carbon monoxide (CO), carbon dioxide (CO2), sulfur oxides (SOx) and other pyrolysis products typical of burning organic material may be produced during combustion or resulting gases..

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus and protective clothing to prevent contact with skin.

C. Accidental Release Measures

Personal Precautions

Wear appropriate protective equipment. Keep unprotected persons away from substance.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

Sweep up, shovel up or vacuum up (consider explosion-proof machines designed to be grounded during storage and use). Place spilled material in clean, dry, sealable, labeled container.

D. Storage And Handling

General Handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. Normal measures for preventive fire protection.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place. Keep away from oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard for sodium fluoroescein has not been established in Australia.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Use suitable respiratory protective device in case of insufficient ventilation.

Hand Protection: The glove material must be impermeable and resistant to the product/ the substance/ the preparation..

Skin Protection: Wear appropriate protective clothing to prevent skin contact.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Sodium fluoroescein is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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SODIUM FORMATE

This dossier on sodium formate presents the most critical studies pertinent to the risk assessment of sodium formate in its use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – sodium formate is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

Sodium formate is an inorganic salt that is highly soluble in water and is expected to fully dissociate to sodium and formate ions in water, and therefore is unlikely to adsorb to soil or sediment. It is readily biodegradable and has a low potential for bioaccumulation.

The acute and chronic toxicity of sodium formate is of low concern to aquatic and terrestrial organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Sodium formate

CAS RN: 141-53-7

Molecular formula: $CHNaO_2$

Molecular weight: 68.007 g/mol

Synonyms: Formic acid, sodium salt, Sodium methanoate, sodium carbanate

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Sodium Formate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	White crystalline powder	2	ECHA
Melting Point	258°C @ 101.3 kPa	2	ECHA
Boiling Point	411°C @ 101.3 kPa	2	ECHA
Density	1910 kg/m^3@ 20°C	2	ECHA
Vapor Pressure	1×10^{-5} Pa @ 20°C (Modified Grain method) 2.9×10^{-6} Pa @ 20°C (Antoine method)	2	ECHA
Partition Coefficient (log K_{ow})	-1.8 @ 20°C	2	ECHA
Water Solubility	1000 g/L @ 20°C	2	ECHA
Dissociation constant (pKa)	3.86 @ 20°C	2	ECHA
Viscosity	Not applicable to a solid	-	ECHA

Sodium formate is a solid substance that is found to be completely soluble in water. Decomposition occurred at 411 °C before boiling occurred during testing at atmospheric pressure.

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for sodium formate.

NICNAS has assessed sodium formate in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to the environment.[1]

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=ab5f433e-f36b-1410-8924-008e64e216c7

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Sodium formate is an inorganic salt that is highly soluble in water and is expected to fully dissociate to sodium and formate ions in water, and therefore is unlikely to adsorb to soil or sediment. It is readily biodegradable and has a low potential for bioaccumulation.

B. Partitioning

Sodium formate dissociates in water to sodium ion and formate ion and both ions are stable in water (ECHA). Sodium formate is not volatile (ECHA).

C. Biodegradation

Sodium formate is readily biodegradable. In a key study with marine microbiota in seawater under aerobic conditions, degradation was 86% after 28 days as measured by oxygen consumption (ECHA) [KI. Score = 1]. Degradation potential in seawater is normally lower than in freshwater tests (ECHA).

In an activated sludge study under aerobic conditions, degradation was 92% after 21 days as measured by dissolved organic carbon (ECHA) [KI. Score = 2].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

D. Environmental Distribution

One study predicted an organic carbon partition coefficient (K_{oc}) of 31 L/kg based on read-across to the formate ion (ECHA) [KI. Score = 2]. Based on this value, sodium formate is expected to have very high mobility in soil. If released to water, it will dissociate (and decompose) to ions and therefore has a low potential for adsorption to soil and sediment.

E. Bioaccumulation

There are no bioaccumulation studies on sodium formate. Sodium formate has a low potential for bioaccumulation. The low Log K_{ow} (-1.8) suggests sodium formate will not bioaccumulate to a substantial degree (ECHA).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

The acute and chronic toxicity of sodium formate is of low concern to aquatic and terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on sodium formate.

Table 3 Acute Aquatic Toxicity Studies on Sodium Formate

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Oncorhynchus mykiss (Rainbow trout fish)	96-hr LC_{50}	>1,000	1	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	>1,000	1	ECHA
Raphidocelis subcapitata (Green algae)	72-hr EC_{50}	>1,000 (growth)	1	ECHA

Chronic Studies

Table 4 lists the results of acute aquatic toxicity studies conducted on sodium formate.

Table 4 Chronic Aquatic Toxicity Studies on Sodium Formate

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Daphnia magna (Water flea)	21-day NOEC	100	1	ECHA
Raphidocelis subcapitata (Green algae)	72-hr NOEC	500 (growth)	1	ECHA

C. Terrestrial Toxicity

No studies available. Direct exposure to soil is unlikely as the substance is readily biodegradable and has a low potential for adsorption (ECHA).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Sodium formate is readily biodegradable; thus, it does not meet the screening criteria for persistence.

Based on a measured log K_{ow} of -1.8, sodium formate does not meet the screening criteria for bioaccumulation.

The lowest chronic NOEC for sodium formate is >0.1 mg/L. The acute E(L)C_{50} values are >1 mg/L. Thus, sodium formate does not meet the screening criteria for toxicity.

The overall conclusion is that sodium formate is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for sodium formate.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required [3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity [2]	
Sodium formate	141-53-7	Not a PBT	No	No	No	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

Department of the Environment and Energy [DoEE]. (2017). Chemical Risk Assessment Guidance Manual: for chemicals associated with coal seam gas extraction, Guidance manual prepared by Hydrobiology and ToxConsult Pty Ltd for the Department of the Environment and Energy, Commonwealth of Australia, Canberra. www.environment.gov.au/water/coal-and-coal-seam-gas/national-assessment-chemicals/consultation-risk-assessment-guidance-manual

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
BCF	bioconcentration factor
COC	constituent of concern
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
KI	Klimisch scoring system
K_{oc}	organic carbon partition coefficient

kPa	kilopascal
L	litre
L/kg	litres per kilogram
LC	lethal concentration
LD	lethal dose
m^3	cubic metre
mg/kg	milligrams per kilogram
mg/L	milligrammes per litre
mg/m^3	milligrams per cubic metre
mL	millilitre
mPa s	millipascal second
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

SODIUM GLUCONATE

This dossier on sodium gluconate presents the most critical studies pertinent to the risk assessment of this substance in its use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from Organization for Economic Cooperation and Development Screening Information Dataset (OECD SIDS) (OECD, 2004). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Sodium gluconate is classified as a tier 1 chemical and requires a hazard assessment only.

1 BACKGROUND

Sodium gluconate is the organic sodium salt of gluconic acid. Sodium gluconate is a chelator that forms stable complexes with various ions and ultimately prevents these ions from engaging in chemical reactions. Gluconates are naturally occurring substances that freely dissociate to the gluconate anion and its respective cations. Gluconates are used as a chelating agent in many cleaning products, industrial applications, and foodstuffs.

Sodium gluconate is readily biodegradable. It is not expected to bioaccumulate, and has low potential to adsorb to sediment and soil. In addition, sodium gluconate has a low acute toxicity to aquatic organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Sodium D-gluconate

CAS RN: 527-07-1

Molecular formula: $C_6H_{11}NaO_7$

Molecular weight: 218.14 g/mol

Synonyms: SODIUM GLUCONATE, Sodium D-gluconate 527-07-1, D-Gluconic acid, monosodium salt, D-Gluconic acid sodium salt

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Sodium Gluconate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Dry, white, crystalline powder	–	NCBI, 2025
Melting Point	205–209°C (pressure not provided)	–	OECD, 2004

Property	Value	Klimisch Score	Reference
Boiling Point	613.1°C (pressure not provided)	-	OECD, 2004
Density	1790 kg/m³	-	NCBI, 2025
Vapor Pressure	Negligible @ 25°C	-	OECD, 2004
Partition Coefficient (log K_{ow})	-5.99	-	OECD, 2004
Dissociation constant (pKa)	3.70	-	OECD, 2004
Water Solubility	590 g/L @ 25°C	-	OECD, 2004
Viscosity	Not Applicable, substance is a solid	-	-

Sodium gluconate is the sodium salt of gluconic acid. Gluconic acid is a naturally occurring weak acid and its dissociation in water is expected to be complete.

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for sodium gluconate.

NICNAS has assessed sodium gluconate in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to human health or the environment.[1]

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE PROPERTIES

A. Summary

Sodium gluconate is readily biodegradable. It is not expected to bioaccumulate and has low potential to adsorb to sediment and soil.

[1] https://www.industrialchemicals.gov.au/chemical-information/search-assessments?assessmentcasnumber=527-07-1

B. Partitioning

Sodium gluconate is highly soluble in water. Volatilization from water or moist soil surfaces is not expected to be an important fate process based upon its water solubility and that it is a salt. It is not expected to volatilize from dry soil surfaces based upon its estimated negligible vapour pressure.

C. Biodegradation

Sodium gluconate is readily biodegradable under both aerobic and anaerobic conditions. In an aerobic closed bottle test of sodium gluconate, the biodegradation was 89% when expressed as the Theoretical Oxygen Demand after 28 days; while under anaerobic conditions, 100% of sodium gluconate was determined as degraded after 35 days. These data demonstrate that gluconates are readily biodegradable both under aerobic and anaerobic test conditions (OECD, 2004).

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

D. Environmental Distribution

No experimental data are available for adipic acid. Using KOCWIN in EPISuite™ (USEPA, 2019), the estimated soil organic carbon partition coefficient (K_{oc}) value from log K_{ow} is 0.0001046 L/kg. The estimated K_{oc} value from the molecular connectivity index (MCI) is 10 L/kg. Based on these values, sodium gluconate has a low potential for adsorption to soil and sediment and is expected to have very high mobility in soil.

E. Bioaccumulation

Based on a log K_{ow} value of -5.99, sodium gluconate has a very low potential for bioaccumulation. This is further supported by metabolic *in vivo* studies showing that gluconate is readily catabolized or utilized for glucose synthesis (OECD, 2004).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Sodium gluconate has low acute toxicity to aquatic organisms. No chronic toxicity studies have been reported.

B. Aquatic Toxicity

Acute Studies

Table 3 presents the results of acute aquatic toxicity studies conducted on Sodium gluconate.

Table 3 Acute Aquatic Toxicity Studies on Sodium Gluconate

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Oryzias latipes (Fish, freshwater)	96-hr LC_{50}	>100	-	OECD, 2004
Daphnids magna (Crustacea)	24-48h NOEC	>1000	-	OECD, 2004

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Selenastrum capricornutum (Algae)	24-72 h $NOEC_r$ 24-72 h E_rC_{50}	560 >1000	-	OECD, 2004

Chronic Studies

No studies reported.

C. Terrestrial Toxicity

No terrestrial toxicity data for gluconates are available. However, the demonstrated biodegradability and the low intrinsic toxicity of gluconates that was observed for aquatic organisms, data on animal toxicokinetic and metabolism (cfr. human toxicology) and their role in mammalian carbohydrate metabolism may predict also a low effect on terrestrial organisms. Therefore, no terrestrial toxicity studies would be required (OECD, 2004).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Sodium gluconate is readily biodegradable; thus, it does not meet the screening criteria for persistence.

The estimated log K_{ow} for sodium gluconate is -5.99. Thus, sodium gluconate does not meet the criteria for bioaccumulation.

There are no chronic aquatic toxicity studies on sodium gluconate. The acute $E(L)C_{50}$ values are >1 mg/L. Thus, sodium gluconate does not meet the screening criteria for toxicity.

Therefore, sodium gluconate is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for sodium gluconate.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Sodium Gluconate	527-07-1	Not a PBT	No	No	No	No	No	No	1	No data	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

Department of the Environment and Energy [DoEE]. (2017). *Chemical Risk Assessment Guidance Manual: for chemicals associated with coal seam gas extraction*. Guidance manual prepared by Hydrobiology and ToxConsult Pty Ltd for the Department of the Environment and Energy, Commonwealth of Australia, Canberra. https://www.dcceew.gov.au/water/coal-and-coal-seam-gas/national-assessment-chemicals/consultation-risk-assessment-guidance-manual

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union

g/cm^3	grams per cubic centimetre
IChEMS	Industrial Chemicals Environmental Management Standard
IMAP	Inventory Multitiered Assessment and Prioritisation
IUPAC	International Union of Pure and Applied Chemistry
KOCWIN	USEPA organic carbon partition coefficient estimation model
kPa	kilopascal
LC	lethal concentration
mg/L	milligrams per litre
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NOEC	no observed effect concentration
OECD	Organization for Economic Cooperation and Development
Pa	Pascal
PBT	Persistent Bioaccumulative Toxic
QSAR	quantitative structure-activity relationship
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

SODIUM LAURYL POLYOXYETHYLENE ETHER SULFATE (CAS RN 9004-82-4)
ALCOHOL ETHOXY SULFATE, SODIUM SALT (CAS RN 68585-34-2)
POLY(OXY-1,2-ETHANEDIYL), ALPHA-SULFO-OMEGA-(DODECYLOXY)-, AMMONIUM SALT (CAS RN 32612-48-9)
POLY(OXY-1,2-ETHANEDIYL), ALPHA-SULFO-OMEGA-(TETRADECYLOXY)-, AMMONIUM SALT (CAS RN 27731-61-9)
POLYETHYLENE GLYCOL (C6-C10) ALKYL ETHER, SULFATE AMMONIUM SALT (CAS RN 68037-05-8)

This dossier on sodium lauryl poloxyethylene ether sulfate, alcohol ethoxy sulfate, sodium salt and three similar alcohol ethoxysulphates (AES) presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Limited information is available for sodium lauryl poloxyethylene ether sulfate, alcohol ethoxy sulfate, sodium salt, and the other three AES in this group; as a result, sodium 2-(2-dodecyloxyethoxy) ethyl sulfate (SDES) has been selected as a surrogate chemical for this review. Based on this read-across data, AES group members are classified as **tier 1** chemicals and require a hazard assessment only.

1 BACKGROUND

Sodium lauryl polyoxyethylene ether sulfate, alcohol ethoxy sulfate, sodium salt and the three similar AES are anionic surfactant detergents. The chemicals in this group are structurally related salts of sulfated ethoxylated lauryl alcohol. Sodium lauryl polyoxyethylene ether sulfate (also known as sodium laureth sulfate), CAS RN 9004-82-4, is a generic CAS registration number that includes the group of chemicals with CAS RNs 15826-16-1, 3088-31-1, 13150-00-0, and 66161-57-7, where they have an average of one, two, three, and 12 ethoxylate units, respectively. Chemical-specific information from group member sodium 2-(2-dodecyloxyethoxy) ethyl sulfate (SDES) (CAS RN 3088-31-1) was used for this review.

SDES is readily biodegradable. It has a strong potential for sorption to soil and sediment. However, it is not expected to bioaccumulate. SDES is of low acute and chronic toxicity concern to aquatic organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): sodium;2-dodecoxyethyl sulfate

CAS RN: 9004-82-4

Molecular formula: $C_{14}H_{29}NaO_5S$

Molecular weight: 332.43 g/mol

Synonyms: sodium lauryl polyoxyethylene ether sulfate; sodium laureth sulfate; dodecyl sodium ethoxysulfate

Chemical Name (IUPAC): poly(oxy-1,2-ethanediyl), .alpha.-sulfo-.omega.-hydroxy-, C10-16-alkyl ethers, sodium salts

CAS RN: 68585-34-2

Molecular formula: Unspecified, substance is a UVCB

Molecular weight: Unspecified, substance is a UVCB

Synonyms: alcohol ethoxy sulfate, sodium salt; (C10-16) alkyl alcohol ethoxylate, sulfated, sodium salt

Chemical Name (IUPAC): azane;2-dodecoxyethyl hydrogen sulfate

CAS RN: 32612-48-9

Molecular formula: $(C_2H_4O)_nC_{12}H_{26}O_4S.H_3N$

Molecular weight: 327.48 g/mol

Synonyms: poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(dodecyloxy)-, ammonium salt; ammonium laureth sulfate; glycols, polyethylene, mono(hydrogen sulfate), dodecyl ether, ammonium salt

Chemical Name (IUPAC): azanium;1-tetradecoxytetradecane;sulfate

CAS RN: 27731-61-9

Molecular formula: $(C_2H_4O)_nC_{14}H_{30}O_4S.H_3N$

Molecular weight: 524.9 g/mol

Synonyms: poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(tetradecyloxy)-, ammonium salt; ammonium myristyl ether sulfate; Glycols, polyethylene, mono(hydrogen sulfate), tetradecyl ether, ammonium salt

Chemical Name (IUPAC): Ethoxylates C6-C10 Alcohol Ammonium Sulfate

CAS RN: 68037-05-8

Molecular formula: Unspecified, substance is a UVCB

Molecular weight: Unspecified, substance is a UVCB

Synonyms: polyethylene glycol (C6-C10) alkyl ether, sulfate ammonium salt; poly(oxy-1,2-ethanediyl), α-sulfo-ω-hydroxy-, C6-10-alkyl ethers, ammonium salts

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for read-across SDES are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Sodium 2-(2-Dodecyloxyethoxy) Ethyl Sulfate[1]

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Odourless and colourless liquid	1	ECHA
Melting Point	183°C (pressure not provided)	-	USEPA, 2025
Boiling Point	113.4 °C @92 kPa	1	ECHA
Density	1990 kg/m^3 @ 20°C	1	ECHA
Vapor Pressure	1.33 x 10^{-10} Pa @ 25°C	1	ECHA
Partition Coefficient (log K_{ow})	-0.602 @ 39°C	1	ECHA
Dissociation Constant (pKa)	2.2 x 10^{-18} @ 20°C	1	ECHA
Water Solubility	1000 g/L @ 39°C	1	ECHA
Viscosity	182.8 mPa s @ 39°C	1	ECHA

[1] - Chemical-specific data is not available for sodium lauryl polyoxyethylene ether sulfate. Data is shown for read-across chemical sodium 2-(2-dodecyloxyethoxy) ethyl sulfate (CAS RN 3088-31-1).

The chemicals in this group are structurally related salts of sulfated ethoxylated lauryl alcohol. The synthesis of the chemicals occurs through similar processes. Lauryl alcohol is ethoxylated with ethylene oxide to form a polyethoxy ether. The terminal alcohol group is then sulfated with sulfur trioxide. The product is neutralised with either sodium or ammonium hydroxide, producing the chemicals of this group. The sodium and ammonium ions are not expected to significantly affect the hazardous properties of the chemicals.

The number of ethoxylate units usually has an average value between one and four. Sodium laureth sulfate, CAS RN 9004-82-4, is a generic CAS registration number that includes the group of chemicals with CAS RNs 15826-16-1, 3088-31-1, 13150-00-0, and 66161-57-7, where they have an average of one, two, three, and 12 ethoxylate units, respectively.

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for sodium lauryl poloxyethylene ether sulfate, alcohol ethoxy sulfate, sodium salt, and the other three AES in this group.

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Chemical-specific data is not available for sodium lauryl poloxyethylene ether sulfate, alcohol ethoxy sulfate, sodium salt, and the other three AES in this group. Data is shown for read-across chemical sodium 2-(2-dodecyloxyethoxy) ethyl sulfate (SDES, CAS RN 3088-31-1).

SDES is readily biodegradable. It has a strong potential for sorption to soil and sediment. However, it is not expected to bioaccumulate.

B. Partitioning

SDES is highly soluble in water. Volatilization from water or moist soil surfaces is not expected to be an important fate process based upon its water solubility and that it is an ionic compound. It is not expected to volatilize from dry soil surfaces based upon its estimated vapour pressure.

The hydrolysis rate constant of sodium 2-(2-dodecyloxyethoxy) ethyl sulfate is estimated to be 454767×10^{-11} cm^3/molecule-sec. at half-life of 2.822 hrs. The estimated half-life of the substance indicates that the substance is moderately hydrolysable (ECHA) [KI. Score = 2].

C. Biodegradation

By applying weight of evidence approach, SDES was found to be readily biodegradable with 50% to 71.199 % percentage degradation (ECHA) [KI. Score = 2]. If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

D. Environmental Distribution

No experimental data are available for SDES. Using KOCWIN in EPISuite™ (USEPA, 2019), the estimated soil organic carbon partition coefficient (K_{oc}) value from the molecular connectivity index (MCI) and log K_{oc} are 2,111 and 3.324 L/kg, respectively (ECHA). Based on this K_{oc} value, if released to soil, SDES is expected to strongly adsorb to soil and have a low potential for mobility. If released to water, based on the K_{oc} value and its high water solubility, it is also expected to adsorb to suspended solids and sediment.

E. Bioaccumulation

There are no bioaccumulation studies on SDES. The BCF was estimated to vary between 70.79 and 72.127 in aquatic organisms and fish (ECHA) [Kl. Score = 2]. Based on the log K_{ow} (-2.03) and the calculated BCFs, bioaccumulation is not to be expected.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Chemical-specific data is not available for sodium lauryl poloxyethylene ether sulfate, alcohol ethoxy sulfate, sodium salt, and the other three AES in this group. Data is shown for read-across chemical sodium 2-(2-dodecyloxyethoxy) ethyl sulfate (SDES, CAS RN 3088-31-1).

SDES is of low acute and chronic toxicity concern to aquatic organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies on SDES.

Table 3 Acute Aquatic Toxicity Studies on SDES (CAS RN 3088-31-1)

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Danio rerio	96-hour LC_{50}	25	2	ECHA
Danio rerio	96-hour LC_{50}	102.59	2	ECHA
Oryzias latipes	48-hour LC_{50}	46	2	ECHA
Daphnia magna	48-hour LC_{50}	86.09	2	ECHA
Pseudokirchneriella subcapitata	72-hour EC_{50} (growth rate)	115.072	2	ECHA
Laminaria hyperborea	24-hour EC_{50}	100 (cell changes)*	2	ECHA

*Data for CAS RN 9004-82-4 (SLES).

Chronic Studies

Based on the prediction done using ECOSAR version 1.1, the long-term toxicity on fish was predicted for SDES. Bases on the effects observed in a static freshwater system, the NOEC value for the substance is estimated to be 36.507 mg/L for fish for 28 days of exposure duration (ECHA) [Kl. Score = 2].

Based on the prediction from ECOSAR version 1.1, the long-term toxicity on aquatic invertebrate was predicted for SDES. Based on the effects observed in a static freshwater system, the NOEC value for the test substance is estimated to be 20.059 mg/L for aquatic invertebrate for 21 days of exposure (ECHA) [Kl. Score = 2].

Since SDES is readily biodegradable in an aquatic environment, it can be concluded that the test chemical is non-toxic to fish and aquatic invertebrates at environmentally relevant concentrations (ECHA).

C. Terrestrial Toxicity

In a 14-day long-term toxicity study with Eisenia fetida (worms), the lethal concentration (LC_{50}) was estimated to be 2600 mg/kg soil dw (ECHA) [Kl. Score = 2].

In a 72-hour short-term study with terrestrial plants (Lactuca sative), the effective concentration (EC_{50}) of SDES was estimated to be 143.2 mg/kg soil dw (ECHA) [Kl. Score = 2].

Considering that the chemical is readily biodegradable in soil, toxicity to soil microorganism, terrestrial plants, terrestrial arthropods and soil microorganisms is not expected (ECHA).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (DEWHA, 2022; ECHA, 2023).

Based on read-across to SDES, sodium lauryl poloxyethylene ether sulfate, alcohol ethoxy sulfate, sodium salt, and the other three AES in this group are readily biodegradable; thus, they do not meet the screening criteria for persistence.

No data are available on bioaccumulation for SDES. However, based on the low log K_{ow} and calculated BCFs, bioaccumulation is not expected. Thus, sodium lauryl poloxyethylene ether sulfate, alcohol ethoxy sulfate, sodium salt, and the other three AES in this group do not meet the screening criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on read-across SDES are >0.1 mg/L. The EC_{50} values for SDES are > 1 mg/L. Thus, sodium lauryl poloxyethylene ether sulfate, alcohol ethoxy sulfate, sodium salt, and the other three AES in this group do not meet the criteria for toxicity.

Therefore, sodium lauryl poloxyethylene ether sulfate, alcohol ethoxy sulfate, sodium salt, and the other three AES in this group are not PBT substances.

B. Other Characteristics of Concern

No other characteristics of concern were identified for sodium lauryl poloxyethylene ether sulfate, alcohol ethoxy sulfate, sodium salt, and the other three AES in this group.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Sodium lauryl polyoxyethylene ether	9004-82-4	Not a PBT	No	No	No	No	No	No	1	1	1
Alcohol ethoxy sulfate, sodium salt	68585-34-2	Not a PBT	No	No	No	No	No	No	1	1	1
Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(dodecyloxy)-, ammonium salt	32612-48-9	Not a PBT	No	No	No	No	No	No	1	1	1
Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(tetradecyloxy)-, ammonium salt	27731-61-9	Not a PBT	No	No	No	No	No	No	1	1	1
Polyethylene glycol (C6-C10) alkyl ether, sulfate ammonium salt	68037-05-8	Not a PBT	No	No	No	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework). Chemical-specific data is not available sodium lauryl poloxyethylene ether sulfate, alcohol ethoxy sulfate, sodium salt, and the other three AES in this group. Data from read-across chemical sodium 2-(2-dodecyloxyethoxy) ethyl sulfate (CAS No. 3088-31-1) was used.

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
CFR	Code of Federal Regulations
COC	constituent of concern
DoEE	Department of the Environment and Energy
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
g/mL	grams per millilitre
GLP	good laboratory procedure

GRAS	generally recognized as safe
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg/m^3	kilogram per cubic metre
KI	Klimisch scoring system
kPa	kilopascal
LC	lethal concentration
mbar	millibar
mg/kg dw	milligrams per kilogram dry weight
mg/L	milligrams per litre
NOEC	no observed effective concentration
OECD	Organisation for Economic Co-operation and Development
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SDES	sodium 2-(2-dodecyloxyethoxy) ethyl sulfate
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency
USFDA	United States Food and Drug Administration

SODIUM METAPHOSPHATE

This dossier on sodium metaphosphate presents the most critical studies pertinent to the risk assessment of this substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): Hexasodium 2,4,6,8,10,12-hexaoxo-2lambda~5~,4lambda~5~,6lambda~5~,8lambda~5~,10lambda~5~,12lambda~5~-cyclohexaphosphoxane-2,4,6,8,10,12-hexakis(olate)

CAS RN: 10124-56-8

Molecular formula: $Na_6O_{18}P_6$

Molecular weight: 611.763 g/mol

Synonyms: Metaphosphoric acid hexasodium salt; sodium metaphosphate

SMILES: [Na+].[Na+].[Na+].[Na+].[Na+].[Na+].[O-]P1(=O)OP([O-])(=O)OP([O-])(=O)OP([O-])(=O)OP([O-])(=O)OP([O-])(=O)O1

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of sodium metaphosphate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Inorganic white solid.	2	ECHA
Melting Point	450°C @ 101.3 kPa	2	ECHA
Boiling Point	Study not conducted. Substance is a solid.	-	ECHA
Density	2580 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	Study not conducted. Melting point greater than 300 °C	-	ECHA
Partition Coefficient (log K_{ow})	Study not conducted. Substance is inorganic.	-	ECHA
Water Solubility	>10 g/L	1	ECHA

Property	Value	Klimisch Score	Reference
Flash Point	Study not conducted. Substance is inorganic.	-	ECHA
Auto flammability	Study not conducted. Melting point too high.	-	ECHA
Viscosity	Study not conducted. Substance is a solid.	-	ECHA
Henry's Law Constant	Not available	-	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Sodium metaphosphate is an inorganic phosphate that will not undergo biodegradation, but it will not persist in natural waters due to its ability to hydrolyse. It has low potential for bioaccumulation.

B. Biodegradation

Biodegradation testing is not relevant for sodium metaphosphate as it is an inorganic phosphate. Sodium metaphosphate will not persist in natural waters and instead will dissociate to its cationic and anionic forms (ECHA).

C. Environmental Distribution

Mobility testing is not possible for sodium metaphosphate as mobility would be dependent on the anion exchange capacity of the soils used in studies (ECHA).

Sodium metaphosphate is an inorganic solid and not volatile. When dissolved in water, it will separate into phosphate and sodium (ECHA).

Sodium metaphosphate in hydrolytically unstable and hydrolyses to simpler phosphate species such as orthophosphate, pyrophosphate, and tripolyphosphate; orthophosphate was determined to be the ultimate hydrolysis product (ECHA).

D. Bioaccumulation

Sodium metaphosphate has low potential for bioaccumulation because it will hydrolyse to orthophosphate in an aquatic system (ECHA). No experimental data on bioaccumulation exist. However, due to the hydrophilic nature of the substance, bioaccumulation is not expected as accumulation in fats is not possible. The substance when dissolved in water (and so animal tissues/fluids) will effectively separate into/become simply the two ions "phosphate" and "sodium" which are natural ionic components of blood, cell fluids, etc and therefore no further testing is considered to be necessary (ECHA).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Sodium metaphosphate is not acutely toxic by the oral and inhalation routes. It is not an irritant to the skin or eyes. Systemic toxicity was not identified in repeat dose studies. Sodium metaphosphate was not mutagenic or carcinogenic and is not considered to be genotoxic. It is not a reproductive or developmental toxicant.

B. Metabolism

Few data are available for the absorption, metabolism and toxicokinetics of sodium metaphosphate. In one *in vitro* study, sodium metaphosphate was demonstrated to by hydrolyzed in rat and porcine intestine. This is consistent with the general metabolic pathway for polyphosphates into linear polyphosphates and finally orthophosphates. Circulating unhydrolyzed sodium metaphosphate is likely excreted via the kidneys while sodium and orthophosphates are excreted in via the kidneys and also in faeces and sweat (ECHA).

C. Acute Toxicity

Oral

An OECD Guideline 420 (Acute Oral Toxicity – Fixed Dose Method) test was conducted in female Wistar rats orally gavaged with a single dose of sodium metaphosphate at 2000 milligrams per kilograms body weight (mg/kg-bw). No mortality or clinical signs of toxicity were recorded during the observation period (14 day) or after necropsy.

Based on this study, the oral LD50 for sodium metaphosphate is identified at 2000 mg/kg-bw (ECHA). [Kl. Score = 1].

Inhalation

An OECD Guideline 403 (Acute Inhalation Toxicity) test was conducted using male and female Sprague-Dawley rats exposed for 4 hrs to sodium metaphosphate dust in a saturated atmosphere (estimated at 3.69 mg per liter of air (mg/L)). After 14 days of observation, no mortality or signs of toxicity were observed outside of irritation from dust exposures on day 1. Based on this study, the inhalation LD50 for sodium metaphosphate is identified as >3.69 mg/L (3,690 mg/m^3) in air (ECHA). [Kl. Score = 1]

D. Irritation

Skin

An OECD Guideline 404 (Acute Dermal Irritation) test was conducted on three New Zealand White rabbits exposed to 0.5 grams (g) of sodium metaphosphate moistened with saline for four hours. Clinical observations for dermal irritation were conducted up to 72 hrs post exposure. Outside of temporary irritation in one subject, no clinical findings were noted. Based on this study, sodium metaphosphate is not classified as irritating to the skin (ECHA). [Kl. Score = 2]

Eye

In an OECD Guideline 405 (Acute Eye Irritation/Corrosion) test, 100 mg of sodium metaphosphate (unchanged) was applied to four White New Zealand rabbits and clinicals findings recorded up to 72 hrs after exposure. In two subjects, eyes were washed after 20-30 seconds of exposure while the remaining two subjects did not have their eyes washed during the study. After one hour, both of the unwashed subjects had severe discharge while only slight discharge was observed in the subjects with washed eyes. Based on this study, sodium metaphosphate is not identified as irritating to the eye (ECHA). [Kl. Score = 2]

E. Sensitisation

In an OECD Guideline 429 (Skin Sensitisation; Local Lymph Node Assay) test, groups of four CBA/CA female mice were treated with a topical application of 2.5%, 5% or 10% sodium metaphosphate in propylene glycol. When compared to the control group, none of the groups exposed to sodium metaphosphate were positive when evaluated via the Stimulation Index (SA). Based on this study, sodium metaphosphate is not identified as skin sensitising (ECHA). [Kl. Score = 1]

F. Repeated Dose Toxicity

Oral

An OECD Guideline 453 (Combined Chronic Toxicology/Carcinogenicity) test was conducted on male and female Rochester rats exposed to concentrations of sodium metaphosphate in diet at concentrations of 0.05%, 0.5% and 5% for two years. In the group fed the 5% diet (50,000 ppm), statistically significant effects on body weight gain and kidney weights were observed. There were no apparent increases in tumour incidence in any of the test groups. Based on a lack of toxicity in the group fed 0.5% (5000 ppm) sodium metaphosphate in diet, a NOAEL of 250 mg/kg-bw/day is identified for this compound (ECHA). [Kl. Score = 2]

Inhalation

No inhalation toxicity studies are available for sodium metaphosphate.

Dermal

No dermal toxicity studies are available for sodium metaphosphate.

G. Genotoxicity

In Vitro Studies

There are no *in vitro* genotoxicity studies on sodium metaphosphate directly, however, a structurally analogous surrogate chemical, sodium dihydrogenorthophosphate (CAS 7558-80-7) has been identified for read across evaluation. The *in vitro* genotoxicity studies for sodium dihydrogenorthophosphate are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on sodium dihydrogenorthophosphate

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 487 (*In vitro* Mammalian Cell Micronucleus Test) (human peripheral lymphocytes)	-	-	1	ECHA
OECD Guideline 490 (*In vitro* Mammalian Cell Gene Mutation Test Using the Thymidine Kinase Gene) (mouse lymphoma L5178Y cells)	-	-	1	ECHA

*+, positive; -, negative

Based on these two in vitro studies for a structurally analogous compound, sodium metaphosphate is not anticipated to be genotoxic (ECHA).

H. Carcinogenicity

In a two-year carcinogenicity study conducted by the United States National Toxicology Program (NTP), male and female Fischer 344/DuCrj rats were fed ad libitum feed with sodium metaphosphate at concentrations of 1.5% and 3% (including controls). An analysis of the neoplastic lesions observed indicated that this compound does not induce tumours in the rodent model used (ECHA). [Kl. Score = 2]

Based on this study and the oral repeated dose study described in Section F, sodium metaphosphate is not identified as a carcinogen.

I. Reproductive Toxicity

A three generation reproduction study was conducted on male and female Rochester rats fed a concentration 0.5% sodium metaphosphate in feed for 100 days prior to mating and through 21 days of gestation and during lactation for all three generations (P1, F1b, F2b), the F3b generation were exposed for 21 days and the sacrificed. No signs of toxicity were observed for reproductive performance, pup mortality, organ weights and organ histopathology. Based on this study, a NOAEL of 250 mg/kg-bw/day is identified for sodium metaphosphate (ECHA). [Kl. Score = 2]

J. Developmental Toxicity

A development study in female time-mated albino CD-1 mice were orally gavaged with a water suspension of sodium metaphosphate at 3.7, 17.2, 79.9 and 370 mg/kg-bw on days 6 through 15 of gestation. No development effects or maternal toxicity were observed at the highest dose of 370 mg/kg-bw/day (ECHA). [Kl. Score = 2]

A similar study in Wistar rats were orally gavaged with a water suspension of sodium metaphosphate at 2.4, 11.1, 51.7 and 240 mg/kg-bw on days 6 through 15 of gestation. No developmental effects or maternal toxicity were observed at the highest dose compared to controls (ECHA). [Kl. Score = 2]

Based on these studies, a NOAEL for developmental effects of 240 mg/kg-day is identified for sodium metaphosphate.

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for sodium metaphosphate follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

~~Oral~~

A chronic study of sodium metaphosphate identified a NOAEL of 250 mg/kg-bw in rats exposed via oral gavage for two years. The NOAEL from this study is based on decreases in body weight and kidney weights in a higher dosed group (2500 mg/kg-bw/day). This NOAEL will be used to derive an oral reference dose and drinking water guideline value for sodium metaphosphate.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 1
UF_D (database uncertainty) = 1
Oral RfD = 250/(10 x 10 x 1 x 1 x 1) = 250/100 = 2.5 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (2.5 x 70 x 0.1)/2 = 8.75 mg/L

B. Cancer

Sodium metaphosphate is not considered a carcinogen based on two 2-year animal studies. Thus, a cancer reference value for this substance is not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Sodium metaphosphate does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Sodium metaphosphate is an inorganic solid that will hydrolyse in water. It is expected to have low acute and chronic toxicity to aquatic organisms. No studies are available for terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on sodium metaphosphate.

Table 3: Acute Aquatic Toxicity Studies on Sodium Metaphosphate

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Oncorhynchus mykiss (Rainbow trout)	96-hr LC_{50}	>100	1	ECHA
Daphnia magna (Water flea)	48-hr EC_{50}	>485 (geometric mean)	1	ECHA
Desmodesmus subspicatus (Green algae)	72-hr EC_{50}	>100 (growth)	1	ECHA

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on sodium metaphosphate.

Table 4: Chronic Aquatic Toxicity Studies on Sodium Metaphosphate

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Desmodesmus subspicatus (Green algae)	72-hr NOEC	32 (growth)	1	ECHA

C. Terrestrial Toxicity

No studies available.

Sodium metaphosphate will ultimately breakdown to give phosphate and sodium ions. Both phosphate and sodium are ubiquitous in the environment and are found naturally in soil, water and sediment. Sodium and phosphate will be assimilated by species residing in the sediment and is necessary to maintain a good chemical balance in soils, water and sediment. Due to the natural

occurrence of the constituent breakdown products of sodium metaphosphate in the environment, it is expected that sodium metaphosphate would not be toxic and hence, toxicity tests are not required (ECHA).

D. Calculation of PNEC

The PNEC calculations for sodium metaphosphate follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (>100 mg/L), invertebrates (>485 mg/L), and algae (>100 mg/L). NOEC values from long-term studies are available for algae (32 mg/L). On the basis that the data consists of short-term results from three trophic levels and long-term results from one trophic level, an assessment factor of 100 has been applied to the lowest reported NOEC value of 32 mg/L for algae. The $PNEC_{water}$ is 3.2 mg/L.

PNEC Sediment

No experimental toxicity data on sediment organisms are available. Octanol/water partition coefficient (K_{ow}) and organic carbon-water partition coefficient (K_{oc}) parameters do not readily apply to inorganics, such as sodium metaphosphate. Thus, the equilibrium partitioning method cannot be used to calculate the $PNEC_{sed}$. Based on its properties, no adsorption of sodium metaphosphate to sediment is to be expected, and the assessment of this compartment will be covered by the aquatic assessment.

PNEC Soil

No experimental toxicity data on soil organisms are available. K_{ow} and K_{oc} parameters do not readily apply to inorganics, such as sodium metaphosphate. Thus, the equilibrium partitioning method cannot be used to calculate the $PNEC_{soil}$. Sodium and phosphate are necessary to maintain a good chemical balance in soils. This compartment will be covered by the aquatic assessment.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Biodegradation testing is not relevant for sodium metaphosphate as it is an inorganic phosphate. Further, sodium metaphosphate will not persist in natural waters and instead will dissociate to its cationic and anionic forms. For the purposes of this PBT assessment, the persistent criteria are not considered applicable to this inorganic phosphate.

Sodium metaphosphate has low potential for bioaccumulation because it will hydrolyse to orthophosphate in an aquatic system. Thus, sodium metaphosphate does not meet the criteria for bioaccumulation.

The NOECs from the chronic aquatic toxicity studies on sodium metaphosphate are > 0.1 mg/L. The acute E(L)C_{50} values from the acute aquatic toxicity studies on sodium metaphosphate are > 1 mg/L. Thus, sodium metaphosphate does not meet the criteria for toxicity.

The overall conclusion is that sodium metaphosphate is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

STOT SE Category 3, H335 (target organ: Lungs)

Skin Irrit. Category 2 H315

Eye Irrit. Category 2, H319

B. Labelling

Warning

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard for sodium metaphosphate in Australia is not available.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Sodium metaphosphate is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

Australian Drinking Water Guidelines [ADWG]. (2011). National Water Quality Management Strategy. Australian Drinking Water Guidelines, Section 6, Australian Government, National Health and Medical Research Council, Natural Resource Management Ministerial Council. Updated June 2025. https://www.nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines

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Klimisch, H.J., Andreae, M., and Tillmann, U. (1997). A systematic approach for evaluating the quality of experimental and toxicological and ecotoxicological data. Regul. Toxicol. Pharmacol. 25:1-5.

SODIUM NITRATE

This dossier on sodium nitrate presents the most critical studies pertinent to the risk assessment of sodium nitrate in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Sodium nitrate was classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

Sodium nitrite ($NaNO_2$) dissociates completely in aqueous solutions to sodium (Na^{++}) and nitrite (NO_2^{2-}) ions. In the environment, bacteria of the genus Nitrobacter oxidises nitrites to nitrates. Nitrates are reduced to nitrogen by anaerobic bacteria present in soil and sediment. Biodegradation is not applicable to sodium nitrite. Sodium nitrite and its dissociated ions are ubiquitous in the environment. They are not expected to adsorb to soil or sediment and have a low potential for bioaccumulation. Toxicity of sodium nitrite is species and water quality dependant. In particular, chloride ion concentration has been shown to be important, with increasing concentrations leading to a decrease in the toxicity of nitrite.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): sodium nitrate

CAS RN: 7631-99-4

Molecular formula: $NaNO_3$

Molecular weight: 84.994 g/mol

Synonyms: nitric acid, sodium salt (1:1); soda niter

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Sodium Nitrate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Colourless hygroscopic crystalline solid	2	ECHA
Melting Point	307°C @ 101.3 kPa	2	ECHA
Boiling Point	Study not conducted. Substance is a solid.	-	ECHA

Property	Value	Klimisch Score	Reference
Density	Study not conducted. Substance is a solid.	-	ECHA
Vapor Pressure	0 Pa @ 20°C	2	ECHA
Partition coefficient (log K_{ow})	Study not conducted. Substance is inorganic.	-	ECHA
Dissociation Constant (pKa)	Not applicable, substance is an inorganic salt	-	ECHA
Water Solubility	100 g/L @ 20°C	2	ECHA
Viscosity	Not applicable substance is a solid	-	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for sodium nitrate.

NICNAS has assessed sodium nitrate in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to human health and the environment.[1][2] It is an inorganic substance comprising ions of low ecotoxicological concern. This chemical is not expected to pose an unreasonable risk to the environment provided that ANZECC[3] water quality guidelines for physical and chemical stressors are not exceeded.

Table 2 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=9475433e-f36b-1410-8de4-00e8f2afc108
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=8be2433e-f36b-1410-8e4e-00f1fcf8411a
[3] Water quality guidelines were revised in 2018 and are now referred to as Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG)

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Sodium nitrite is an inorganic salt and will dissociate immediately into sodium and nitrate ions in water. Based on its high water solubility, it is unlikely to adsorb to soil or sediment. It has a low potential for bioaccumulation.

B. Partitioning

Sodium nitrate ($NaNO_3$) dissociates completely in aqueous solutions to sodium (Na^{++}) and nitrate (NO_3^{2-}) ions. Nitrates are reduced to nitrogen by anaerobic bacteria present in soil and sediment.

C. Biodegradation

Biodegradation testing is not relevant for sodium nitrate as it is an inorganic salt. Sodium nitrate will not persist in natural waters and denitrification will occur under anaerobic conditions. Its daughter products include nitrite, oxide of nitrogen, nitrogen, and ammonia (ECHA).

D. Environmental Distribution

Sodium nitrate has high solubility (100 g/L) and will exist in a dissociated form in water as sodium cations and nitrate ions. The substance will follow water movement and has low potential to adsorb to soil and sediment. The sodium cation is more likely to adsorb to solids than the nitrate ion (ECHA).

Sodium nitrate is unlikely to volatilize (ECHA, CESAR). Hydrolysis and photodegradation are not important fate processes for this substance (ECHA).

E. Bioaccumulation

Sodium nitrate has low potential for bioaccumulation because it will readily dissociate into ions in water (ECHA, CESAR). The nitrate ion has high solubility and is not lipophilic (ECHA).

Nitrates are not expected to bioaccumulate based on the fact that they are salts that dissociate in aqueous environments. Nitrate can be taken up by plants or denitrified again to yield nitrogen and nitrous oxide gas. However, nitrates can have indirect and long-term effects on ecosystems, e.g. eutrophication (OECD, 2007).

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

The toxicity of sodium nitrate is species and water quality dependant with the preponderance of the data reflecting effective concentrations in the part per million range.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on sodium nitrate (nitrate ion).

Table 3 Acute Aquatic Toxicity Studies on Sodium Nitrate

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Cyprinus carpio (Common carp fish)	48-hr LC_{50}	346	2	ECHA
Ceriodaphnia silvestrii (Water flea)	48-hr LC_{50}	340	2	ECHA
Raphidocelis subcapitata (formerly Pseudokirchneriella subcapitat) (Green algae)	72-hr EC_{50}	>71 (growth)	3	ECHA

Chronic Studies

Table 4 lists the results of chronic aquatic toxicity studies conducted on sodium nitrate (nitrate ion).

Table 4: Chronic Aquatic Toxicity Studies on Sodium Nitrate (Nitrate Ion)

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Notropis topeka (Topeka shiner fish)	30-day NOEC	1,187	2	ECHA
Pimephales promelas (Fathead minnow fish)	30-day NOEC	257	2	ECHA
Ceriodaphnia dubia (Water flea)	7-day NOEC	69	2	ECHA
Daphnia magna (Water flea)	7-day NOEC	1,585	2	ECHA
Raphidocelis subcapitata (Green algae)	72-hr EC_{50}	≥71 (growth)	3	ECHA
Scenedesmus quadricauda (green algae)	7-day TT	1,233 (test substance was nitrite)	3	OECD, 2007

C. Terrestrial Toxicity

Sodium nitrate has high solubility and will dissociate in the water. The nitrate ion is ubiquitous in the environment and is essential for soil organisms (ECHA). Sodium nitrate is expected to have low acute and chronic toxicity to terrestrial organisms.

In a study conducted on *Coturnix coturnix* japonica (Japanese quail), levels of nitrate had a significant, but inconsistent effect on weight gain. Neither food nor water consumption during growing or laying phases nor hen-day egg production were significantly affected by levels of nitrate used. An LC_{100} of 5,280 ppm (day 3 post treatment) and 5,940 ppm (day 4 post treatment) were determined (OECD, 2007).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Sodium nitrate is an inorganic salt that dissociates completely to sodium and nitrate ions in aqueous solutions. Biodegradation is not applicable to these inorganic ions; both sodium and nitrate ions are also ubiquitous and denitrification will occur under anaerobic conditions. For the purposes of this PBT assessment, the persistent criteria are not considered applicable to this inorganic salt.

As sodium nitrate dissociates to sodium and nitrate ions, neither sodium nitrate nor its dissociated ions are expected to bioaccumulate. Thus, it does not meet the screening criteria for bioaccumulation.

The NOEC values from chronic fish studies on sodium nitrate are >0.1 mg/L. The acute EC_{50} values for sodium nitrate are >1 mg/L in fish, invertebrates and algae. Thus, sodium nitrate does not meet the screening criteria for toxicity.

The overall conclusion is that sodium nitrate is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for sodium nitrate.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Sodium Nitrate	7631-99-4	Not a PBT	No	No	NA	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
ANZECC	Australian and New Zealand Environment and Conservation Council
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
dw	dry weight
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard
IMAP	Inventory Multitiered Assessment and Prioritisation
IUPAC	International Union of Pure and Applied Chemistry

kg/m^3	kilograms per cubic metre
kPa	kilopascal
LC	lethal concentration
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NOEC	no observed effective concentration
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases

SODIUM POLYNAPHTHALENE SULFONATE (CAS RN 9008-63-3)
2-NAPHTHALENESULFONIC ACID, POLYMER WITH FORMALDEHYDE, SODIUM SALT (CAS RN 36290-04-7)
SODIUM SALT OF SULFONATED NAPHTHALENEFORMALDEHYDE CONDENSATE (CAS RN 9084-06-4)
SULFONATED ORGANIC POLYMER (CAS RN 526203-62-3)

This group contains sodium polynaphthalene sulfonate and similar sulfonated polymers. They are expected to have similar environmental concerns and have consequently been assessed as a group. Information provided in this dossier is based on primarily sodium polynaphthalene sulfonate and similar read-across group members.

This dossier on sodium polynaphthalene sulfonate and similar sulfonates presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. It does not represent an exhaustive or critical review of all available data. Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Sodium polynaphthalene sulfonate; 2-naphthalenesulfonic acid, polymer with formaldehyde, sodium salt; sodium salt of sulfonated naphthaleneformaldehyde condensate; and, sulfonated organic polymer are classified as **tier 1** chemicals and requires a hazard assessment only.

1 BACKGROUND

Sodium polynaphthalene sulfonate (SPNS) functions as an emulsion stabilizer, surfactant – dispersing agent, and a surfactant – hydrotrope in cosmetic products. It is used as a raw material in the production of admixtures for the construction industry and is one of the basic ingredients for formulation of chemical admixtures for concrete and mortars. It is defined as the sodium salt of the product obtained by the condensation polymerization of 2-naphthalene sulfonic acid and formaldehyde.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Naphthalenesulfonic acid, sodium salt, polymer with formaldehyde

CAS RN: 9008-63-3

Molecular formula: $(C_{10}H_8O_3S.CH_2O.Na)_x$ [This substance is a polymer.]

Molecular weight: Unspecified

Synonyms: Sodium polynaphthalene sulfonate; naphthalenesulfonic acid, sodium salt, polymer with formaldehyde; sodium naphthalenesulfonate-formaldehyde copolymer; naphthalenesulfonic acid sodium salt/formaldehyde polymer; formaldehyde/naphthalenesulfonic acid

Chemical Name (IUPAC): sodium formaldehyde naphthalene-2-sulfonate

CAS RN: 36290-04-7

Molecular formula: $(C_{10}H_8O_3S.CH_2O)_x.xNa$ [This substance is a polymer.]

Molecular weight: 238.26 g/mol (monomer)

Synonyms: Formaldehyde, polymer with 2-naphthalenesulfonic acid, sodium salt, 2-Naphthalenesulfonic acid, polymer with formaldehyde, sodium salt

Chemical Name (IUPAC): naphthalenesulfonic acid, polymer with formaldehyde, sodium salt

CAS RN: 9084-06-4

Molecular formula: $(C_{10}H_8O_3S.CH_2O)_x.xNa$ [This substance is a polymer.]

Molecular weight: Unspecified

Synonyms: Sodium salt of sulfonated naphthaleneformaldehyde condensate, Formaldehyde-naphthalenesulfonic acid condensate sodium salt

Chemical Name (IUPAC): Protein hydrolyzates, reaction products with acetone, formaldehyde, formic acid and sodium sulfite (2:1)

CAS RN: 526203-62-3

Molecular formula: Unspecified

Molecular weight: Unspecified

Synonyms: None

3 PHYSICO-CHEMICAL PROPERTIES

According to Hampshire Chemical Corp. (1995), SPNS is made by reacting naphthalene with sulfuric acid under conditions of heat and pressure. Formaldehyde and water are then added to produce the acid polymer under the same conditions of heat and pressure. Caustic is added to the acid polymer resulting in the final product (CIR, 2003).

SPNS is tan or amber in powdered form and brown in liquid form. It is completely soluble with a density of 400 – 700 kg/m^3. The substance has a percent (%) volatility of 3 % to 7 % water (CIR, 2003).

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 1). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for these sulfonates.

NICNAS has assessed 2-naphthalenesulfonic acid, polymer with formaldehyde, sodium salt in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to human health or the environment.[1]

Table 1 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

As a class, the lower molecular weight/bioavailable non-polymeric ammonium, potassium and sodium naphthalenesulfonate formaldehyde condensate surfactants have the following physicochemical profile:

- Non-volatile
- High melting point
- Not lipophilic, but with increasing log K_{ow} with increasing methylation, going from -0.32 for naphthalenesulfonic acids, reaction products with formaldehyde, sodium salts (CAS RN 91078-68-1) to 0.78 for methylnaphthalene sulfonate (no CAS RN)
- Binds tightly to soil
- Oxidative degradation within 8 hours
- Biodegradable with affinity for water and soil compartments (USEPA, 2017)

6 ENVIRONMENTAL EFFECTS SUMMARY

No data are available for these polymeric substances. In lieu of this lack of information, data are taken from the monomeric subunit, sodium naphthalene-2-sulphonate (CAS RN 532-02-5) though it should be noted that toxicity is likely overestimated when read across from the monomer to the polymer.

A. Aquatic Toxicity

Acute toxicity of sodium naphthalene-2-sulphonate to freshwater fish and invertebrates was estimated using USEPA's ECOSAR v1.00 predictor. The 96-hr LC_{50} for freshwater fish was calculated to be 105,000 mg/L [KI Score = 2] (ECHA) while the 48-hr EC_{50} for the invertebrate *Daphnia Magna* was estimated to be 49,421.05 mg/L [KI Score = 2] (ECHA). Based on the QSAR prediction done using the Danish (Q)SAR Database, the 72-hr EC_{50} for the alga, *Pseudokirchnerella subcapitata* was

[1] https://www.industrialchemicals.gov.au/chemical-information/search-assessments?assessmentcasnumber=36290-04-7

estimated to be 4767.52 mg/L [KI Score = 2] (ECHA). The 100-hr EC_{50} was determined to be 135 mg/L for *Daphnia magna* [KI Score=2] (ECHA).

No chronic studies are available.

B. Terrestrial Toxicity

No data are available.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Sodium polynaphthalene sulfonate is a polymer; it is not expected to be biodegradable. Thus, it meets the criteria for persistence.

Sodium polynaphthalene sulfonate is not expected to bioaccumulate due to its low potential for bioavailability, its expected molecular weight and size and low water solubility.

No aquatic toxicity studies are available for sodium polynaphthalene sulfonate. The acute $E(L)C_{50}$ values for read-across substance sodium naphthalene 2-sulphonate are >1 mg/L in fish, invertebrates and algae. Therefore, it does not meet the screening criteria for toxicity.

The overall conclusion is that sodium polynaphthalene sulfonate is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for sodium polynaphthalene sulfonate.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment[1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
Sodium Polynaphthalene Sulfonate	9008-63-3	Not a PBT	No	No	Yes	No	No	No	1	1	1
2-Naphthalenesulfonic acid, polymer with formaldehyde, sodium salt	36290-04-7	Not a PBT	No	No	Yes	No	No	No	1	1	1
Sodium salt of sulfonated naphthaleneformaldehyde condensate	9084-06-4	Not a PBT	No	No	Yes	No	No	No	1	1	1
Sulfonated Organic Polymer	526203-62-3	Not a PBT	No	No	Yes	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only based on a read across to the monomeric subunit, sodium naphthalene-2-sulphonate.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
EC	effect concentration
ECHA	European Chemicals Agency
ECOSAR	Ecological Structure Activity Relationships (ECOSAR v1) Class Program, Risk Assessment Division of the Office of Pollution Prevention and Toxics, U.S. Environmental Protection Agency (U.S. EPA/OPPT).
EU	European Union
IChEMS	Industrial Chemicals Environmental Management Standard
IMAP	Inventory Multitiered Assessment and Prioritisation
IUPAC	International Union of Pure and Applied Chemistry
LC	lethal concentration
mg/L	milligrams per litre
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
QSAR	Quantitative Structure Activity Relationship

SODIUM SILICATE
PUMICE

This dossier on sodium silicate and pumice presents the most critical studies pertinent to the risk assessment of these substances in their use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The information presented in this dossier was obtained from the OECD-SIDS documents on Soluble Silicates, which includes sodium silicate (OECD, 2004); and from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed sodium silicate in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to the environment.[1]

NICNAS has assessed pumice in an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and concluded that it poses no unreasonable risk to human health and the environment.[2][3]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): Sodium hydroxysilanoylolate

CAS RN: 1344-09-8

Molecular formula: $Na_2O \cdot nO_2Si$

Molecular weight: 184.04 (tetrasodium orthosilicate); soluble silicates are not generally stoichiometric chemical substances (with a specific chemical formula and molecular weight), but rather glasses or aqueous solutions of glasses.

Synonyms: Water glass; soluble glass; silicate of soda; sodium orthosilicate; sodium silicate glass.

SMILES: [O-][Si]([O-])([O-])[O-].[Na+].[Na+].[Na+].[Na+]

Chemical Name (IUPAC): Pumice

CAS RN: 1332-09-8

Molecular formula: Unspecified

Molecular weight: Unspecified

Synonyms: Pumice; Hyuega soil

SMILES: Not applicable

[1] https://services.industrialchemicals.gov.au/search-assessments/?assessmentcasnumber=1344-09-8
[2] https://services.industrialchemicals.gov.au/assessment-detail/?id=e380433e-f36b-1410-8c14-0026b2c59b62
[3] https://services.industrialchemicals.gov.au/assessment-detail/?id=585e433e-f36b-1410-8924-008e64e216c7

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties could not be found for pumice. Physical and chemical properties for sodium silicate are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of sodium silicate

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Translucent, blue-greenish or yellow-brownish solid	2	ECHA
Melting Point	730–870°C (flow point)	2	ECHA
Boiling Point	Not Applicable, melting point > 300 °C	-	ECHA
Density	1260 – 1710 kg/m³ (solutions); 700–800 kg/m³ (bulk density; spray-dried powders) (temperature not provided)	2	ECHA
Vapour Pressure	Negligible at ambient temperature	2	ECHA
Partition Coefficient (log K_{ow})	Not relevant	-	ECHA
Water Solubility	Dissolves readily (spray-dried solutions) 0.115 g/L @ 25°C (amorphous silica)	2	ECHA
Flash Point	Not Applicable, substance is an inorganic	-	ECHA
Auto flammability	Not relevant	-	ECHA
Viscosity	Not Applicable, substance is a solid	-	ECHA
Henry's Law Constant	Not Available	-	-

Sodium silicate is produced by fusing high purity quartz sand (SiO_2) and sodium carbonate or soda (Na_2CO_3) at temperatures of 1,300 to 1,500°C. The product that is formed is an amorphous glass that can be dissolved in water to produce silicate solutions. Various products of sodium silicate are obtained by varying the mixing ratio of quartz and soda. Sodium silicates are therefore characterised primarily by the SiO_2 to Na_2O ratio, or molar ratio (MR). Soluble silicates are generally not distinct stoichiometric chemical substances (with a specific chemical formula and molecular weight), but glasses or aqueous solutions of glasses (OECD, 2004).

Sodium silicate is an amorphous glass, and it is solidified as a glass from the melt (solid or lump glasses). It is essentially anhydrous and differs from ordinary glasses in that it is soluble in water at elevated temperature and pressure leading to silicate solutions (liquid glasses). Both solid and liquid glasses are often referred to as waterglass. Silicate solutions are defined by their density and viscosity, which together with the MR defines a unique composition for the silicate solution. By evaporation of silicate solutions, fine powders or granules are obtained that have a residual water content of approximately 20%. Unlike ground lump glass, these materials dissolve readily in water to give silicate solutions (OECD, 2004).

Pumice is a volcanic stone consisting of aluminium, sodium and potassium silicates. Limited information is available for pumice. Therefore, information is read-across in this dossier for component sodium silicate.

III. ENVIRONMENTAL FATE PROPERTIES

Sodium silicate readily dissolves in water to sodium ions (Na+) and molecular speciation of silicates. Dissolved silica from commercial soluble silicates is indistinguishable from natural dissolved silica. Silica (SiO_2) represents about 59% of the elemental composition of the earth's crust. Similar percentages are obtained for many sediments and soils (Jackson, 1964). Compounds of silicon and oxygen are ubiquitous in the environment; it is present in inorganic matter, like minerals and soils and in organic matter.

Silica is found in all natural waters and the median values in the United States were reported to be 17 mg SiO_2/L for ground waters and 14 mg SiO_2/L for streams (Davis, 1964). The world-wide concentration in rivers is 13 mg SiO_2/L (Edwards and Liss, 1973).

Sodium silicate and pumice are inorganic substances and therefore not amenable to biodegradation. They are not expected to bioaccumulate.

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Sodium silicate exhibits low acute toxicity by the oral and dermal routes. It can be irritating to corrosive to the skin of rabbits, depending on their molar ratio and concentration; it is not a dermal sensitizer. There is a low potential for toxicity from repeated oral exposures to sodium silicate. It is not genotoxic. Limited data indicate that sodium silicate does not pose a developmental hazard.

B. Metabolism

Rats were given a single oral dose of 40 or 1,000 mg/kg sodium silicate. Following oral dosing, excretion of silicon in the urine markedly increased and was most rapid during the first 24 hours post-dosing. At 40 and 1,000 mg/kg, 18.9% and 2.8%, respectively, of administered silicate was excreted in the urine. The urinary excretion half-life for ingested sodium silicate was calculated to be 24 hours. Although urinary excretion of silicon increased with dose level, the magnitude of this increase was smaller than the increase in dose, suggesting either absorption or excretion or both of silicon becomes saturated (Benke and Osborn, 1979).

C. Acute Toxicity

The acute oral LD50 value of sodium silicate in rats is 3,400 mg/kg (ECHA). [Kl. score = 2]. In another study, the oral LD50 value of sodium silicate in rats was reported to be 5,150 mg/kg (ECHA). [Kl. score = 2]

There are no acute inhalation studies on sodium silicate. The 4-hour LC50 value in rats for potassium silicate is >2.06 mg/L. There were no deaths and animals gained weight over the 14-day observation period. During exposure, animals showed hunched posture and hypoactivity, but recovered after the exposure period. No abnormalities were noted at gross necropsy (ECHA). [Kl. score = 1]

There are no acute dermal toxicity studies on sodium silicate. The acute dermal LD50 value in rats for potassium silicate is >5,000 mg/kg (ECHA). [Kl. score = 1]

D. Irritation

Sodium silicates can be irritating to corrosive to the skin of rabbits, depending on their molar ratio and concentration (OECD, 2004). At comparable concentrations (38-41%), sodium silicates with ratios of 2.0 and 2.4 were irritating, but ratios of 2.8 and 3.3 were not irritating (OECD, 2004). Sodium silicates of molar ratios ≤1.6 and concentrations of >50% were found to be corrosive (OECD, 2004).

E. Sensitisation

Sodium silicate was considered to be a skin sensitizer in a mouse local lymph node assay (ECHA). [Kl. score = 1]

F. Repeated Dose Toxicity

Oral

Male and female Wistar rats were given in their drinking water 0, 200, 600 or 1,800 ppm polysodium silicate ($Na_2O.nSiO_2$) for 90 days. Polysodium silicate is assumed to be metasilicate. The mean daily intake was estimated to be (as sodium metasilicate): 26.4, 76.2, and 227.1 mg/kg-day for males; and 32.1, 97.6, and 237.2 mg/kg-day for females. There were no clear treatment-related effects. The NOAEL for this study is considered to be 227.1 and 237.2 mg/kg-day for males and females, respectively (OECD, 2004; ECHA). [Kl. score = 2]

Male and female mice were administered in their drinking water sodium metasilicate. The doses for males were 0, 300, 900, and 2,700 ppm which were estimated to be 0, 96-100, 264-280, and 776-832 mg/kg-day, respectively. The doses for females were 0, 333, 1,000 and 3,000 which were estimated to be 0, 88-104, 260-284, and 716-892 mg/kg-day, respectively. Parameters examined were body weight, urinalysis, clinical chemistry, haematology, organ weights, and histopathology. There were no deaths during the study. A significant decrease in pituitary gland weights were seen in the 3,000 ppm females. There were no other effects noted that were considered to be treatment-related. The NOAEL was considered to 260-284 mg/kg-day (OECD, 2004; ECHA). [Kl. score = 2]

Male and female SD rats were given sodium silicate in their drinking water for 180 days. The animals were administered 0, 600, or 1,600 mg SiO_2/L, which were estimated to be 0, 79, or 159 mg/kg-day sodium silicate taking into account a diet containing 0.1 to 1.0% SiO_2 (based on dry weight). Body weight and mortality were the only parameters measured. There were statistical differences in body weight between treated and control groups; these differences were small (≤6%) and were not consistent or dose-related. There were no deaths during the study. After 180 days of exposure, the male rats were used in a nitrogen and phosphorus retention study for a total of 17 days. Phosphorus retention was somewhat increased in the 159 mg/kg-day dose group (~12%), while the low-dose group showed no change. Nitrogen retention was 50% of controls in the lower dose group only. It is unclear whether the increased phosphorus retention in the high-dose animals represents an adverse effect or not. For the purposes of this dossier, the NOAEL for this study is 159 mg/kg-day as sodium silicate, the highest dose tested (Smith *et al.*, 1973; OECD, 2004). [Kl. score = 2]

Inhalation

No studies are available.

Dermal

No studies are available.

G. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on sodium silicate are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on sodium silicate

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial reverse mutation (*S. typhimurium* and *E. coli* strains)	-	-	1	ECHA
Mammalian cell gene mutation (Chinese hamster lung fibroblasts, V79)	-	-	1	ECHA
Chromosomal aberrations (Chinese hamster lung fibroblasts, V79)	-	-	1	ECHA

*+, positive; -, negative

In Vivo Studies

Mice fed 740 to 1,340 mg/kg sodium metasilicate for 24 hours did not exhibit increased chromosomal aberrations in bone marrow cells (ECHA). [Kl. score = 2]

H. Carcinogenicity

Oral

No studies are available.

Inhalation

No studies are available.

Dermal

No studies are available.

I. Reproductive Toxicity

There is a four-generation reproductive toxicity study on sodium silicate (Smith *et al.*, 1973), but this study is considered inadequate for hazard and risk assessments because of the severe methodology limitations of the study and the high mortality rates in the treated and control animals.

J. Developmental Toxicity

Pregnant female mice were dosed by oral gavage 0, 12.5, 50, or 200 mg/kg sodium metasilicate in aqueous solution from GD 0 to 17 or 18. There were four deaths in the treated dams: two in the 50

mg/kg and two in the 200 mg/kg dose groups. Maternal body and organ weights were similar between treated and control dams. The number of pregnancies, living and dead foetuses, foetal body weights, and malformations were similar across groups. A subgroup of pregnant dams was allowed to deliver their pups and the neonates were observed for 30 days. Litter size, fertility index, pup body weight gain, organ weights, and behavioural development were unaffected by treatment. The NOAEL for developmental toxicity is 200 mg/kg-day, the highest dose tested (OECD, 2004; ECHA) [Kl. score = 2].

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for sodium silicate follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

~~Oral~~

The lowest NOAEL from three repeated dose toxicity studies conducted on sodium silicate or sodium metasilicate is 159 mg/kg-day from the 180-day drinking water study by Smith *et al.* (1973). The NOAEL of 159 mg/kg-day will be used to derive the oral reference dose and drinking water guidance values.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

- UF_A (interspecies variability) = 10
- UF_H (intraspecies variability) = 10
- UF_L (LOAEL to NOAEL) = 1
- UF_{Sub} (subchronic to chronic) = 3
- UF_D (database uncertainty) = 1
- Oral RfD = 159/(10 x 10 x 1 x 3 x 1) = 159/300 = 0.5 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

- Human weight = 70 kg (ADWG, 2011)
- Proportion of water consumed = 10% (ADWG, 2011)
- Volume of water consumed = 2L (ADWG, 2011)
- Drinking water guidance value = (0.5 x 70 x 0.1)/2 = 1.8 mg/L

B. Cancer

No carcinogenicity studies are available. Therefore, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Sodium silicate and pumice do not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Sodium silicate is of low toxicity concern to aquatic organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on sodium silicate. No information was available for pumice.

Table 3: Acute Aquatic Toxicity Studies on sodium silicate

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Brachydanio rerio	96-hr LC_{50}	1,180	2	OECD, 2004; ECHA
Oncorhynchus mykiss	96-hr LC_{50}	260 - 310	2	ECHA
Daphnia magna	48-hr EC_{50}	1,700	2	OECD, 2004; ECHA
Scenedesmus subspicatus	72-hr EC_{50}	>345.4 (growth rate)	2	OECD, 2004; ECHA

Chronic Studies

No chronic studies are available.

C. Terrestrial Toxicity

There are no studies on sodium silicate. A honeybee acute contact toxicity study (USEPA OPPTS 850.3020) has been conducted on AgSil™ 25 potassium silicate solution (29.1% potassium silicate in water). The 48-hr LD_0 was 25 µg/animal and the 48-hr LD_{50} was 25 µg/animal (ECHA).

D. Calculation of PNEC

The PNEC calculations for sodium silicate and pumice follow the methodology discussed in DEWHA (2009).

PNEC Water

A $PNEC_{water}$ was not calculated. The primary hazard of commercial soluble silicates is their moderate-to-strong alkalinity, which can be harmful to aquatic life. However, most of natural and artificial aquatic ecosystems are slightly acid or alkaline and usually their pH values fall within the range of 6 to 9, and due to the high buffer capacity of these ecosystems pH effects of released soluble silicates to aquatic organisms are very unlikely. Consequently, the PNEC derived from artificial laboratory test systems overestimate the effects of soluble silicates to aquatic organisms in ecosystems (OECD, 2004). Therefore, the PNEC value should be derived from the ubiquitous SiO_2 background concentration in the environment. The world-wide mean concentration in rivers is 13 mg SiO_2/L (Edwards and Liss, 1973).

PNEC Sediment

No experimental toxicity data on sediment organisms are available. Sodium silicate dissociates completely in water with its environmental distribution is dominated by its high water solubility. K_{ow} and K_{oc} parameters do not readily apply to inorganics, such as sodium silicate. Therefore, the equilibrium partitioning method cannot be used to calculate the $PNEC_{sed}$. Based on its properties, no adsorption of sodium silicate to sediment is to be expected, and the assessment of this compartment will be covered by the aquatic assessment.

PNEC soil

No experimental toxicity data on soil organisms are available. Sodium silicate dissociates completely in water with its environmental distribution is dominated by its high water solubility. K_{ow} and K_{oc} parameters do not readily apply to inorganics, such as sodium silicate. Therefore, the equilibrium partitioning method cannot be used to calculate the $PNEC_{soil}$. Based on its properties, no adsorption of sodium silicate to soil is to be expected, and the assessment of this compartment will be covered by the aquatic assessment.

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Sodium silicate is an inorganic compound that dissociates completely to sodium and silicate ions in aqueous solutions. Biodegradation is not applicable to these inorganic ions; both sodium and silicate ions are also ubiquitous and are present in most water, soil and sediment. For the purposes of this PBT assessment, the persistent criteria are not considered applicable to this inorganic compound or pumice.

Sodium and silicate ions are essential to all living organisms and is ubiquitous in the environment. Therefore, sodium silicate and pumice, using read-across, are not expected to bioaccumulate.

No chronic toxicity data exist on sodium silicate or pumice; however, the acute $E(L)C_{50}$ values are >1 mg/L in fish, invertebrates and algae for sodium silicate. Therefore, sodium silicate and pumice, using read-across, do not meet the screening criteria for toxicity.

The overall conclusion is that sodium silicate and pumice are not PBT substances.

IX. CLASSIFICATION AND LABELLING

A. Classification

The classification and labelling for sodium silicate depends on the molar ratio. Molar ratios define the ratio of SiO2 versus Na2O in the substance. The extent to which balancing sodium ions are present in a given silicate is defined by the molar ratio. The higher the molar ratio, the less sodium ions are present in the silica network and consequently the less sodium ions are present in the silica network and consequently the less alkaline the silicates are. From the molar ratio, the concentration of SiO2 and Na2O can be calculated. The concentration of Na2O can be taken as a measure for the skin and eye irritation potency. The EU defines relationship between molar ratios, specific concentrations limits and GHS classifications for sodium silicate (see GHS classification for sodium silicate in the ECHA REACH database).

The concentration and molar ratio of sodium silicate product that is used as a cement additive are 30-60% and >3.2.

Not Classified.

B. Labelling

No signal word.

C. Pictogram

None.

X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

Immediately flush open eyes with plenty of water for at least 15 minutes. Remove contacts, if present and easy to do. Get medical attention immediately.

Skin Contact

Wash thoroughly with water. Remove contaminated clothing and shoes. Get medical attention. Wash contaminated clothing before reuse.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Ingestion

Rinse mouth with water. Do not induce vomiting. Never give anything by mouth to an unconscious person. If symptoms develop, seek medical advice.

B. Fire Fighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus and chemical-protective clothing.

C. Accidental Release Measures

Personal Precautions

Keep unnecessary personnel away. Spills of this product are very slippery. Avoid contact with skin, eye, and clothing. Use personal protective clothing. Do not breathe mist or vapor. Ensure adequate ventilation. Wear respiratory protection if ventilation is inadequate.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage And Handling

General Handling

Avoid contact with eyes, skin, or clothing. Avoid breathing mist. Material is slippery underfoot. Ensure adequate ventilation. Wash hands after use. Launder contaminated clothing before reuse. Use appropriate protective equipment.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

Workplace exposure standards have not been established in Australia for sodium silicate or pumice.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Not normally needed. But if significant exposures are possible then the following respirator is recommended: Dust/mist respirator.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Full protective chemical resistant clothing. Rubber apron.

Eye protection: Chemical goggles; also wear a face shield if splashing hazard exists.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Sodium silicate (MR >3.2) is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods Code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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SORBITAN, MONO-9-OCTADECENOATE, (Z)
POLYOXYETHYLENE SORBITAN TIOLEATE
SORBITAN, MONOPALMITATE
SORBITAN, TRI, (9Z)-9-OCTADECENOATE

This dossier on four sorbitan chemicals presents the most critical studies pertinent to the risk assessment of sorbitan, mono-9-octadecenoate, (Z), polyoxyethylene sorbitan tioleate, sorbitan, monopalmitate and sorbitan, tri, (9Z)-9-octadecenoate in their use in coal seam gas or shale extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): [(2*R*)-2-[(2*R*,3*R*,4*S*)-3,4-dihydroxyoxolan-2-yl]-2-hydroxyethyl] (*Z*)-octadec-9-enoate

CAS RN: 1338-43-8

Molecular formula: $C_{24}H_{44}O_6$

Molecular weight: 428 g/mol

Synonyms: Sorbitan monooleate; sorbitan, mono-9-octadecenoate, (Z)

SMILES: CCCCCCCCC=CCCCCCCCC(=O)OCC(C1C(C(CO1)O)O)O

Chemical Name (IUPAC): Sorbitan, tri-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs.

CAS RN: 9005-70-3

Molecular formula: Unspecified, UVCB

Molecular weight: Unspecified, UVCB

Synonyms: Polyethylene glycol sorbitan trioleate; PEG Sorbitan trioleate

SMILES: Not available

Chemical Name (IUPAC): [(2R)-2-[(2R,3R,4S)-3,4-dihydroxyoxolan-2-yl]-2-hydroxyethyl] hexadecanoate

(2R)-2-[(2R,3R,4S)-3,4-dihydroxyoxolan-2-yl]-2-hydroxyethyl hexadecanoate

CAS RN: 26266-57-9

Molecular formula: $C_{22}H_{42}O_6$

Molecular weight: 402.6 g/mol

Synonyms: sorbitan, monopalmitate, D-Glucitol, 1,4-anhydro-, 6-hexadecanoate, Sorbitan monohexadecanoate

SMILES: [H][C@@]1(OC[C@H](O)[C@H]1O)[C@H](O)COC(=O)CCCCCCCCCCCCCCC

Chemical Name (IUPAC): [(2*R*)-2-[(2*R*,3*R*,4*S*)-4-hydroxy-3-[(*Z*)-octadec-9-enoyl]oxyoxolan-2-yl]-2-[(*Z*)-octadec-9-enoyl]oxyethyl] (*Z*)-octadec-9-enoate

CAS RN: 26266-58-0

Molecular formula: $C_{60}H_{108}O_8$

Molecular weight: 957.5 g/mol

Synonyms: sorbitan, tri, (9Z)-9-octadecenoate, Anhydrosorbitol trioleate,

SMILES:
CCCCCCCC/C=C\CCCCCCCC(=O)OC[C@H]([C@@H]1[C@@H]([C@H](CO1)O)OC(=O)CCCCCCC/C=C\CCCCCCCC)OC(=O)CCCCCCC/C=C\CCCCCCCC

II. PHYSICO-CHEMICAL PROPERTIES

Limited information was available for polyethylene glycol sorbitan trioleate. Key physical and chemical properties for the other substances are shown in Table 1.

Table 1: Overview of the physico-chemical properties of sorbitan mono-9-octadecenate, (Z); sorbitan, monopalmitate and sorbitan, tri, (9Z)-9-octadecenoate

Property	sorbitan, mono-9-octadecenoate, (Z)			sorbitan, monopalmitate,			sorbitan, tri, (9Z)-9-octadecenoate		
	Value	Klimisch Score	Reference	Value	Klimisch Score	Reference	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Yellow to amber liquid	-	HPVIS	Solid	2	ECHA	Organic Liquid	2	ECHA
Melting Point	223°C (estimated, pressure not provided)	-	HPVIS	46-48°C @ 101.3 kPa	2	ECHA	-14°C @ 101.3 kPa	2	ECHA
Boiling Point	535°C (estimated, pressure not provided)	-	HPVIS	>300°C @ 101.3 kPa Decomposition probable	2	ECHA	>300 °C @ 101.3 kPa Decompose before boiling	2	ECHA
Density	1000 kg/m^3 @ 25°C	-	HPVIS	960-1090 kg/m^3@ 20°C	2	ECHA	947 kg/m^3@ 2°C	2	ECHA
Vapour Pressure	Negligible	-	HPVIS	< 0.0001 Pa @ 20°C	2	ECHA	< 0.00001 Pa @ 20°C	2	ECHA
Partition Coefficient (log K_{ow})	5.89 (estimated), temperature not provided	-	HPVIS	>10 @ Temperature not reported	2	ECHA	>10 @ Temperature not reported	2	ECHA
Water Solubility	0.0191 (estimated) (insoluble) @ 25°C	-	NCBI, 2024	0.00005 g/L @ 20°C	2	ECHA	<0.0001 g/L @ 20°C	2	ECHA
Flash Point	Not Available	-	-	Not applicable. Substance is a solid	-	ECHA	225°C	2	ECHA

Property	sorbitan, mono-9-octadecenoate, (Z)			sorbitan, monopalmitate,			sorbitan, tri, (9Z)-9-octadecenoate		
	Value	Klimisch Score	Reference	Value	Klimisch Score	Reference	Value	Klimisch Score	Reference
Auto flammability	Not Available		-	Not applicable. Substance is a solid	-	ECHA	Non flammable in air.	-	ECHA
Viscosity	100 m Pa/s		NCBI, 2024	Not applicable. Substance is a solid	-	ECHA	120 mPa s @ 40°C	2	ECHA
Henry's Law Constant	Not available	-	-	Not available	-	ECHA	Not available	-	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Environmental fate data of the substance or reasonable surrogates suggests that it will degrade in the environment, not persist, and due to expected metabolism is not likely to bioaccumulate.

The data supporting these conclusions are discussed below.

B. Biodegradation

Sorbitan, mono-9-octadecenoate, (Z) is readily biodegradable. In an OECD 301 C test, degradation was 58% after 14 days and 62% after 28 days (HPVIS). In a read-across, sorbitan stearate (CAS RN 1338-41-6) is readily biodegradable. In an OECD 301 C test, degradation was 88% after 28 days (ECHA) [Kl.score=1].

If a chemical is found to be readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

No experimental data are available for sorbitan, mono-9-octadecenoate, (Z). Using KOCWIN in EPISUITE™ (EPA, 2019), the estimated Koc value from log Kow is 1,599 L/kg. The estimated Koc value from the molecular connectivity index (MCI) is 2,423 L/kg. Based on these estimated K_{oc} values, the substance is likely to adsorb to soil or sediments, and unlike other more immobile Sorbitan Esters in this category, will have slight mobility.

D. Bioaccumulation

There are no bioaccumulation studies on sorbitan, mono-9-octadecenoate, (Z). Sorbitan, mono-9-octadecenoate, (Z) has an estimated log Kow of 5.89 (EPA, 2019). However, sorbitan, mono-9-octadecenoate, (Z) is expected to be metabolized and excreted. The metabolic pathway involves enzymatic hydrolysis by esterases to D-glucitol and the respective fatty acid. The fatty acids are metabolized by the beta-oxidation pathway and D-glucitol will undergo metabolism by the fructose metabolic pathway in the liver (ECHA). Using the Arnot-Gobas method involving biotransformation in the QSAR model BCFBAF v3.01, the BCF values ranged from 36 to 92 L/kg, indicating a low potential for bioaccumulation (USEPA, 2019).

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Based on read-across to similar sorbitan esters, members of this group have low acute oral, inhalation and dermal toxicity. They are not expected to be irritating to the eyes, or the skin and are not skin sensitisers. They have low oral repeated dose toxicity, and were not genotoxic in any *in vitro* assay. They are not carcinogenic nor are they a reproductive or developmental toxicant.

B. Toxicokinetics/Metabolism

Metabolism of the sorbitan esters in animals has been reported to occur initially via enzymatic hydrolysis, leading to sorbitan and the corresponding natural fatty acids. Oral gavage studies in rats

with radiolabeled sorbitan monostearate (CAS RN 1338-41-6), which is structurally similar to sorbitan, mono-9-octadecenoate, (Z), have demonstrated that about 90% of the sorbitan monostearate dose was absorbed and hydrolyzed to stearic acid and sorbitan (Elder, 1985; Wick, 1953). The resulting sorbitan and fatty acid metabolites, in turn would be expected to be metabolized further (via fatty acid beta-oxidation or carbohydrate metabolic pathways) to either smaller and more polar water-soluble metabolites, which can be excreted in the urine or as carbon dioxide exhaled in the lungs.

As the molecular weight of sorbitan stearate (CAS RN 1338-41-6) ranges between 402.57 and 981.56 g/mol, an absorption of the molecule in the gastrointestinal tract is in general improbable. Sorbitan stearate has a low vapour pressure of < 0.0001 Pa at 25 °C, thus, being of low volatility. Therefore, under normal use and handling conditions, inhalation exposure and thus availability for respiratory absorption of the substance in the form of vapours, gases, or mists is not expected to be significant. However, the substance may be available for respiratory absorption in the lung after inhalation of aerosols, if the substance is melted and sprayed. In humans, particles with aerodynamic diameters below 100 µm have the potential to be inhaled. Particles with aerodynamic diameters below 50 µm may reach the thoracic region and those below 15 µm the alveolar region of the respiratory tract (ECHA, 2008). Lipophilic compounds with a log Pow > 4 that are poorly soluble in water (1 mg/L or less) like sorbitan stearate can be taken up by micellar solubilisation. Overall, a systemic bioavailability of Sorbitan stearate in humans is considered likely after inhalation of aerosols with aerodynamic diameters below 15 µm. Dermal absorption of sorbitan stearate was predicted to be very low with an estimated dermal permeability coefficient (Kp) of 0.068 cm/h and a dermal absorption rate of 0.000037 mg/cm²/h (=0.00000918 mg/cm²/event) (ECHA) [Kl.score=2]. The high log P_{ow} of > 5 implies that Sorbitan stearate may have the potential to accumulate in adipose tissue (ECHA). Sorbitan fatty acid esters will undergo esterase-catalysed hydrolysis, leading to the cleavage products D-glucitol and fatty acids. The log Pow of the first cleavage product D-glucitol is -2.2, indicating a high solubility in water. Consequently, there is no potential for D-glucitol to accumulate in adipose tissue. The second cleavage product, the fatty acids, can be stored as triglycerides in adipose tissue depots or be incorporated into cell membranes. At the same time, fatty acids are also required as a source of energy. Thus, stored fatty acids underlie a continuous turnover as they are permanently metabolized and excreted. Bioaccumulation of fatty acids only takes place, if their intake exceeds the caloric requirements of the organism. Due to the high molecular weight and the insolubility in water, excretion of Sorbitan stearate via urine is unlikely after oral administration. After oral ingestion, sorbitan fatty acid esters will undergo stepwise chemical changes in the gastro-intestinal fluids as a result of enzymatic hydrolysis. As the physico-chemical characteristics of the cleavage products (e.g. physical form, water solubility, molecular weight, log Pow vapour pressure, etc.) will be different from those of the parent substance the predictions based upon the physico-chemical characteristics of the parent substance do no longer apply (ECHA) However, also for both cleavage products, it is anticipated that they will be absorbed in the gastro-intestinal tract. Overall, the available information indicates that sorbitan stearate is expired as CO_2 after metabolic degradation. Moreover, depending on the cleavage products, biliary excretion with the faeces (fatty acids) and via urine (D-glucitol) is likely (ECHA).

C. Acute Toxicity

No studies are available on sorbitan, mono-9-octadecenoate, (Z).

Oral

The oral LD_{50} in rats for sorbitan monopalmitate is >15,900 mg/kg (ECHA) [Kl.score=2].

An OECD Guideline 401 (Acute Oral Toxicity) study was conducted using male and female Wistar rats exposed to 2000 mg/kg bw/day sorbitan stearate (CAS RN 1338-41-6) via oral gavage. No mortality occurred during the study period. The LD_{50} was reported as >2,000 mg/kg bw/day (ECHA) [Kl.score=2].

Inhalation

The 4-hour inhalation LC_{50} value for sorbitan monolaurate (CAS RN 1338-39-2) was reported as >5000 mg/m^3 based on a study conducted using male and female Wistar rats exposed to sorbitan monolaurate via a nose only aerosol for four hours. No mortality was reported in this study. (ECHA) [Kl.score=2].

Dermal

No acute dermal toxicity studies are available.

D. Irritation

Skin

Application of 0.5 g sorbitan palmitate (CAS RN 26266-57-9) to the skin of New Zealand white rabbits for 24 hours under occlusive conditions was not irritating (ECHA) [Kl.score=2].

Eye

An OECD guideline 405 (Acute Eye irritation/Corrosion) study was conducted using an unspecified strain for rabbits exposed to 0.1 grams of sorbitan stearate (CAS RN 1338-41-6) for 7 days. Sorbitan stearate was reported as non irritating in under the conditions of this study (ECHA) [Kl.score =2].

E. Sensitisation

No studies are available for sorbitan, mono-9-octadecenoate, (Z)

F. Repeated Dose Toxicity

Oral

Sorbitan stearate was tested in a combined repeated dose toxicity study with a reproductive/developmental screening (OECD 422) test. Male and female SD rats were dosed by oral gavage with 0, 40, 200, or 1,000 mg/kg sorbitan stearate (CAS RN 1338-41-6). There were no systemic effects that were considered to be treatment-related. The NOAEL for systemic toxicity is 1,000 mg/kg-day, the highest dose tested (ECHA) [Kl.score=2].

Inhalation

No studies are available.

Dermal

No reliable studies are available.

G. Genotoxicity

In Vitro Studies

There are no *in vitro* genotoxicity studies on sorbitan mono-9-octadecenate, (Z). Table 2 shows the results of *in vitro* genotoxicity studies on read-across substances sorbitan stearate (CAS RN 1338-41-6) and sorbitan laurate (CAS RN 1338-39-2).

Table 2: *In vitro* genotoxicity studies on sorbitan stearate and sorbitan laurate

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial reverse mutation (*S. typhimurium* and *E. coli* strains)	-	-	2	ECHA
Mammalian cell gene mutation (mouse lymphoma L5178Y cells)**	-	-	2	ECHA
Chromosomal aberration (human lymphocytes)**	-	-	2	ECHA

*+, positive; -, negative

In Vivo Studies

No studies are available.

H. Carcinogenicity

No studies are available on sorbitan mono-9-octadecenoate, (Z). Furthermore, there is no evidence that sorbitan fatty acid esters induce gene mutations in bacteria or chromosome aberrations in mammalian cells, as the results of all genotoxicity studies were consistently negative. Furthermore, in the available repeated dose toxicity studies and developmental studies, no substance-related increases in the incidence of hyperplasia or pre-neoplastic lesions were observed. The available and relevant studies do not indicate that sorbitan fatty acid esters fulfil the criteria for classification as germ cell mutagen or that they are able to induce hyperplasia and/or pre-neoplastic lesions. Furthermore, the weight of evidence from all available information leads to the conclusion that sorbitan fatty acid esters are not carcinogenic. Therefore, a carcinogenicity study is scientifically unjustified (ECHA).

Oral

Male and female TO mice were given in their diet 0, 0.5, 2, or 4% sorbitan stearate (CAS RN 1338-41-6) for 80 weeks. The estimated daily intakes were 0, 650, 2,600, and 5,200 mg/kg. Body weights were similar across all groups throughout the study. There were no increases in tumour incidence that were considered to be treatment-related (ECHA) [Kl.score=2].

Inhalation

There are no studies available.

Dermal

There are no studies available.

I. Reproductive Toxicity

No studies are available on sorbitan mono-9-octadecenoate, (Z).

Sorbitan stearate (CAS RN 1338-41-6) was tested in a combined repeated dose toxicity study with a reproductive/developmental screening (OECD 422) test. Male and female SD rats were dosed by oral gavage with 0, 40, 200, or 1,000 mg/kg sorbitan stearate. There were no systemic, reproductive, or developmental effects that were considered to be treatment-related. The NOAEL for reproductive and developmental toxicity is 1,000 mg/kg-day, the highest dose tested (ECHA) [Kl.score=2].

J. Developmental Toxicity

Oral

A combined repeated dose/developmental toxicity screening study was performed according to OECD 422 with sorbitan stearate (CAS RN 1338-41-6) in male and female Sprague-Dawley rats. Seven to 12 rats were daily orally treated with 40, 200, 1000 mg/kg bw/d of the sorbitan stearate. Females were treated 2 weeks before mating through day 4 of lactation (about 40 days) and the males for 42 days. Control animals were treated with the vehicle. In parental animals, no mortality was observed, and no abnormalities related to the treatment. In the offspring, mortality was observed as follows: 2 dams of the 40 mg/kg bw/d dose group lost all pups and an additional dam lost 9/13 pups, potentially due to lack of lactation on day 1. No further mortalities of newborns were observed at any dose. The number of abnormalities seen in the visceral and skeletal tissues in test animals did not differ from spontaneously occurring abnormalities in the controls. The only exception was the occurrence of a filamentous tail in one pup of the 1000 mg/kg bw/d dose group. The effect was considered as not treatment-related but as common effect in Sprague-Dawley rats. With regard to the described effects, a developmental NOAEL of≥1000 mg/kg bw/d was determined (ECHA) [Kl.score=2].

The effects of sorbitan stearate (CAS RN 1338-41-6) on foetal development after oral administration to pregnant animals was also investigated in Wistar rats. The rats were given oral doses 500 or 1000 mg/kg bw/d of sorbitan stearate from day 0 to day 20 of gestation. At sacrifice on day 20 of gestation, no differences between dose and control groups were observed with regard to clinical signs, body weights and post-mortem examinations of organs. One foetus of the highest dose group showed retardation (no further details were given). As this effect was not observed in other foetuses of the same dose group, it was considered to be incidental and not treatment-related. Two foetuses of the 500 mg/kg bw dose group and one fetus of the 1000 mg/kg bw dose groups showed incomplete ossification of cervical vertebral arches. A cervical rib was observed in one control group animal, in four animals of the 500 mg/kg bw/day dose group, and in three foetuses at dosing of 1000 mg/kg bw/d. Asymmetry of sternebrae was observed in four foetuses of the 500 mg/kg bw group and five foetuses of the highest dose group. Incompletely ossified sternebrae was found in 27 foetuses at dosing of 500 mg/kg bw and in 39 foetuses at dosing of 1000 mg/kg bw/d. A lumber rib was observed in one fetus of the 500 mg/kg bw/d dose group and in three control group animals. Since the effects described occurred to the same extent in control and test group animals, the changes were not assumed to be caused by sorbitan stearate, but as natural occurrence in comparison with background data of the test laboratory. In the 1000 mg/kg bw/d dose group, body weight gain of foetuses was slightly suppressed but there was no significant difference when compared to controls. Therefore, a developmental NOAEL of≥1000 mg/kg bw/d was determined (ECHA) [Kl.score=2].

Inhalation

There are no studies available.

Dermal

There are no studies available.

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for sorbitan mono-9-octadecenoate, (Z) follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

There are no repeated dose toxicity studies on sorbitan mono-9-octadecenoate, (Z). Sorbitan monostearate, a structurally similar substance to sorbitan mono-9-octadecenoate, (Z) has been tested in an OECD 422 rat oral gavage study. The NOAEL for systemic, reproductive, and developmental toxicity is 1,000 mg/kg-day. The NOAEL of 1,000 mg/kg-day will be used to derive an oral RfD and drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / ($UF_A \times UF_H \times UF_L \times UF_{Sub} \times UF_D$)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 1,000/(10 × 10 × 1 × 10 × 1) = 1,000/1,000 = 1.0 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) × (human weight) × (proportion of intake from water) / (volume of water consumed) × (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) × (human weight) × (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (1.0 × 70 × 0.1)/2 = 3.5 mg/L

B. Cancer

There are no carcinogenicity studies on sorbitan mono-9-octadecenoate, (Z). Sorbitan monostearate (CAS RN 1338-41-6) was not carcinogenic to mice. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Sorbitan mono-9-octadecenoate, (Z) does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Acute and chronic studies indicate that Sorbitan esters are of relatively low toxicity to aquatic organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on sorbitan, mono-9-octadecenoate, (Z) or read-across sorbitan stearate.

Table 3: Acute aquatic toxicity studies on sorbitan, mono-9-octadecenoate, (Z) and sorbitan stearate

Test Species	Endpoint	Results (mg/L)	Klimisch Score	Reference
Salmo gairdneri	96-hr LL_{50}	>1,000 [WAF]	2	HPVIS
Oryzias latipes	96-hr LL_{50}	>1,000 [WAF]*	1	ECHA
Daphnia magna	48-hr EL_{50}	>1,000 [WAF]*	2	ECHA
Pseudokirchneriella subcapitata	72-hr EL_{50}	>1,000 [WAF]*	1	ECHA

*Studies conducted on sorbitan stearate (CAS No. 1338-41-6).

Chronic Studies

The 21-day NOELR (no-observed-effect-loading-rate) in a *Daphnia* reproduction test for sorbitan stearate (CAS No. 1338-41-6) is 16 mg/L WAFA (ECHA) [Kl.score=2].

The 72-hr NOELR (no-observed-effect-loading-rate) to *Pseudokirschneriella subcapitata* for sorbitan stearate is 560 mg/L [WAF] (ECHA) [Kl.score=1].

C. Terrestrial Toxicity

No data are available.

D. Calculation of PNEC

The PNEC calculations for the Sorbitan esters follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute E(L)L_{50} values are available for fish (>1,000 mg/L WAF), invertebrates (>1,000 mg/L WAF), and algae (>1,000 mg/L WAF). Results from chronic studies are available for invertebrates (16 mg/L WAF) and algae (560 mg/L WAF). On the basis that the data consists of short-term studies for three trophic levels and long-term results studies for two trophic levels, an assessment factor of 50 has been applied to the lowest reported NOELR of 16 mg/L for invertebrates. The $PNEC_{water}$ is 0.32 mg/L WAF.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 11.83 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (47.3/1280) \times 1000 \times 0.32$
$= 11.83$ mg/kg

Where:

$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 96.9/1000 \times 2400]$
$= 47.3\ m^3/m^3$

Where:

Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
$= 2,423 \times 0.04$
$= 96.9$ L/kg

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for sorbitan, mono-9-octadecenoate, (Z) calculated from EPISUITE™ using the MCI is 2,423 L/kg.
f_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There are no toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 10.3 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
$= (48.46/1500) \times 1000 \times 0.32$
$= 10.3$ mg/kg

Where:
Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
$Kp_{soil} = K_{oc} \times f_{oc}$
$= 2,423 \times 0.02$
$= 48.46\ m^3/m^3$

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for sorbitan, mono-9-octadecenoate, (Z) calculated from EPISUITE™ using the MCI is 2,423 L/kg.
F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Sorbitan esters are readily biodegradable. Thus, they do not meet the screening criteria for persistence.

The estimated BCF values (involving biotransformation) for Sorbitan ester group members ranged from 36 to 92 L/kg. Thus, they do not meet the criteria for bioaccumulation.

The lowest chronic NOELR for read-across substance sorbitan stearate is >0.1 mg/L. The acute $E(L)L_{50}$ values are >1 mg/L. Thus, Sorbitan esters do not meet the screening criteria for toxicity.

The overall conclusion is that Sorbitan esters are not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

sorbitan, mono-9-octadecenoate, (Z) and Polyoxyethylene sorbitan trioleate

Not classified.

sorbitan, monopalmitate

STOT SE Category 3, H335

sorbitan, monopalmitate and sorbitan, tri, (9Z)-9-octadecenoate

Skin Irrit. Category 2, H315

Eye Irrit. Category 2, H319

B. Labelling

sorbitan, mono-9-octadecenoate, (Z) and Polyoxyethylene sorbitan trioleate

No signal word.

sorbitan, monopalmitate and sorbitan, tri, (9Z)-9-octadecenoate

Warning

C. Pictogram

sorbitan, mono-9-octadecenoate, (Z) and Polyoxyethylene sorbitan trioleate

None

sorbitan, monopalmitate and sorbitan, tri, (9Z)-9-octadecenoate



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

If inhaled, remove from area to fresh air. Get medical attention.

Ingestion

Rinse mouth with water and then drink a glass of water. Get medical attention. Never give anything by mouth to an unconscious person.

B. Firefighting Information

Extinguishing Media

Water spray, carbon dioxide, foam, dry chemical.

Specific Exposure Hazards

Keep product and empty container away from heat and sources of ignition. May emit toxic fumes under fire conditions. Depending on conditions, decomposition products may include the following: carbon monoxide, carbon dioxide.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

For large amounts: dike spillage and pump off product. For residues: pick up with suitable absorbent material. Dispose of contaminated material as prescribed.

D. Storage and Handling

General Handling

Keep product and empty container away from heat and sources of ignition. Ensure adequate ventilation, especially in confined areas.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

Workplace Australia has not established an occupational exposure standard for sorbitan, mono-9-octadecenoate, (Z), polyoxyethylene sorbitan trioleate, sorbitan, monopalmitate, sorbitan, tri, (9Z)-9-octadecenoate.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: Respiratory protection is not required.

Hand Protection: Chemical resistant protective gloves.

Skin Protection: Body protection must be chosen depending on activity and possible exposure.

Eye Protection: Safety glasses with side-shields.

Other Precautions: Handle in accordance with good industrial hygiene and safety practice. Wearing of closed work clothing is recommended. Ensure that eyewash stations and safety showers are close to the workstation location.

F. Transport Information

Sorbitan, mono-9-octadecenoate, (Z), polyoxyethylene sorbitan trioleate, sorbitan, monopalmitate and sorbitan, tri, (9Z)-9-octadecenoate are not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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STYRENE BUTADIENE LATEX (CAS RN 403824-26-0)
2-PROPENOIC ACID, POLYMER WITH 1,3-BUTADIENE AND ETHENYLBENZENE (CAS RN 25085-39-6)
2-PROPENENITRILE, POLYMER WITH 1,3-BUTADIENE (CAS RN 9003-18-3)
STYRENE/1,3-BUTADIENE COPOLYMER (CAR RN 9003-55-8)

This group contains copolymers consisting of styrene, butadiene, acrylic acid or acrylonitrile monomers. They are expected to have similar environmental concerns and have consequently been assessed as a group. This dossier on styrene butadiene latex and similar polymers presents the most critical studies pertinent to the risk assessment of these polymers in their use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. Information provided in this dossier is based on similar anionic polymer group members. Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Styrene butadiene latex, 2-propenenitrile, polymer with 1,3-butadiene and styrene/1,3-butadiene copolymer are polymers of low concern. Therefore, these polymers and the other similar polymer in this group are classified as **tier 1** chemicals and require a hazard assessment only.

1. BACKGROUND

Styrene butadiene latex and similar polymers in this group are anionic (or potentially anionic) synthetic copolymers. They are formed by addition polymerisation, which typically affords high molecular weight polymers with stable saturated carbon-chain backbones.

No studies on the environmental fate of these polymers are available. Synthetic anionic polymers are not expected to undergo rapid degradation. However, based largely on their high molecular weight, these substances are not expected to bioaccumulate or bioconcentrate. They are of low toxicity to environmental receptors.

2. CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): 2-Propenoic acid, polymer with 1,3-butadiene and ethenylbenzene

CAS RN: 25085-39-6

Molecular formula: $(C_8H_8.C_4H_6.C_3H_4O_2)_x$

Molecular weight: 230.30 g/mol (monomer)

Synonyms: butadiene, styrene, acrylic acid latex; ethenylbenzene, 1,3-butadiene, 2-propenoic acid polymer

Chemical Name (IUPAC): 1-Propanesulfonic acid, 2-methyl-2-[(1-oxo-2-propenyl)amino]-, monosodium salt, polymer with 1,3-butadiene and ethenylbenzene

CAS RN: 403824-26-0

Molecular formula: $(C_8H_8.C_7H_{13}NO_4S.C_4H_6.Na)_x$

Molecular weight: No information is available

Synonyms: styrene butadiene latex

Chemical Name (IUPAC): 2-Propenenitrile, polymer with 1,3-butadiene

CAS RN: 9003-18-3

Molecular formula: $(C_4H_6.C_3H_3.C_3N)_x$

Molecular weight: 107.15 g/mol (monomer)

Synonyms: 1,3-butadiene, acrylonitrile polymer

Chemical Name (IUPAC): Benzene, ethenyl-, polymer with 1,3-butadiene

CAS RN: 9003-55-8

Molecular formula: $(C_8H_8.C_4H_6)_x$

Molecular weight: 158.24 g/mol (monomer)

Synonyms: styrene, 1,3-butadiene polymer

3. PHYSICO-CHEMICAL PROPERTIES

No chemical-specific information is available. Polymers in this group are anionic (or potentially anionic) synthetic copolymers. They are formed by addition polymerisation, which typically affords high molecular weight polymers with stable saturated carbon-chain backbones. They are expected to be water soluble based on the predominantly hydrophilic structure of the substances. In water, they are expected to dissociate to release similar high molecular weight polyanions and simple counterions (DoEE, 2017).

As noted, no information is available regarding the molecular weight and the percentage of low molecular weight (LMW) species in these polymers. However, synthetic addition polymers of this type are generally high to very high molecular weight species. It is assumed for this polymer that the number average molecular weight (NAMW) is greater than 1,000 Daltons (Da) with an insignificant percentage of LMW species (DoEE, 2017).

4. DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 1). These chemicals are listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for their use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for this polymer group.

NICNAS has assessed styrene butadiene latex (CAS RN 403824-26-0), 1,3-butadiene, acrylonitrile polymer (CAS RN 9003-18-3) and styrene, 1,3-butadiene polymer (CAS RN 9003-55-8) in an Inventory

Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 assessment and considers each a polymer of low concern.[1]

Internationally, USEPA has assessed 2-propenoic acid polymer, with 1,3-butadiene and ethenylbenzene (CAS RN 25085-39-6) and considers it a low-risk polymer. There were no concerns for risks associated with any potential exposure scenarios that are reasonably foreseeable[2].

Table 1 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5. ENVIRONMENTAL FATE SUMMARY

No studies are available.

Polymers with a molecular weight greater than 1,000 g/mol generally have a negligible vapor pressure, which indicates that the chemical is likely to exist solely as particulate matter in the atmosphere. As particulate matter, atmospheric oxidation is not expected to be a significant route of environmental removal. Likewise, volatilisation from water or moist soil is not expected to occur at an appreciable rate (USEPA, 2013).

These polymers are not expected to be readily biodegradable. Their physico-chemical properties (stable carbon-chain backbone) would preclude them from undergoing significant biodegradation (Guiney *et al.*, 1997). Biodegradation is limited due to the very high molecular weight. The copolymer will likely bind tightly to organic matter found within soils and sediments (Guiney *et al.*, 1997). The copolymer is not expected to bioaccumulate because of its high molecular weight (DoEE, 2017).

6. ENVIRONMENTAL EFFECTS SUMMARY

No ecotoxicity data was identified for the polymers in this group. Information on Anionic Polymers Group (DoEE, 2017) is provided below.

> *"High molecular weight anionic polymers (including water-soluble polyanions) generally have low toxicity to fish and aquatic invertebrates. These polymers cannat be obsorbed acrass biolagical membranes in aquatic arganisms, and therefore toxicity only accurs thraugh indirect effects such as chelatian of essential nutrients. This is supparted by median lethal*

[1] https://www.industrialchemicals.gov.au/help-and-guides/polymer-low-concern-plc-criteria
[2] https://www.federalregister.gov/documents/2010/06/04/2010-13320/2-propenoic-acid-polymer-with-13-butadiene-and-ethenylbenzene-tolerance-exemption

concentration (LC50) values available for anionic polymers which are typically greater than 100 mg/L (Boethling and Nabholz 1997).

Water soluble or dispersible anionic polymers may be moderately toxic to algae because they have the potential to over-chelate Ca^{2+} and Mg^{2+} cations which are essential nutrients needed for growth (Boethling and Nabholz 1997). Toxicity by this mechanism is directly related to the carbon distance between acid functional groups. The highest toxicity occurs when the acid is on alternating carbons of the polymer backbone and homopolymers of acrylic acid generally have the highest indirect toxicity to algae for this reason (Boethling and Nabholz 1997).

The polymers in this group may have some potential to chelate Ca^{2+} and Mg^{2+} cations if they have a significant number of repeating acid units in the polymer structure. However, the toxicity to algae is likely to be reduced under most circumstances due to the presence of background concentrations of calcium ions in most applications, which will bind to the chelating residues in the polymers before they are released to the environment. Even under optimal conditions for toxicity of homopolymers of acrylic acid, the measured median effect concentration (EC50) values for these indirect toxicity effects to algae are greater than 3 mg/L (Boethling and Nabholz 1997).

Water-soluble or dispersible polymers with NAMW less than 1 000 Da, or significant levels of LMW substances and trapped monomers, are of concern because of their bioavailability. However, this assessment is conducted assuming that the polymers have NAMW greater than 1 000 Da and the percentage of LMW species is low."

7. CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU Reach Criteria methodology (IChEMS, 2022; ECHA, 2023).

Polymers in this group are not readily biodegradable; thus, they meet the screening criteria for persistence.

Polymers in this group are expected to have a very high molecular weight. They are not expected to be bioavailable. Thus, these copolymers do not meet the criteria for bioaccumulation.

There are no aquatic toxicity studies on polymers in this group. They are expected to have low concern for aquatic toxicity because of their very high molecular weight and that they cannot be absorbed across biological membranes in aquatic organisms, and therefore toxicity only occurs through indirect effects such as chelation of essential nutrients. Thus, these copolymers do not meet the criteria for toxicity.

The overall conclusion is that styrene butadiene latex; 1,3-butadiene, acrylonitrile polymer; styrene, 1,3-butadiene polymer; and, 2-propenoic acid polymer, with 1,3-butadiene and ethenylbenzene are not PBT substances.

B. Other Characteristics of Concern

No other characteristics of concern were identified for these polymers.

8. SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
Styrene butadiene latex	403824-26-0	Not a PBT	No	Yes	Yes	No	No	No	1	1	1
1,3-Butadiene, acrylonitrile polymer	9003-18-3	Not a PBT	No	Yes	Yes	No	No	No	1	1	1
Styrene, 1,3-butadiene polymer	9003-55-8	Not a PBT	No	Yes	Yes	No	No	No	1	1	1
2-Propenoic acid polymer, with 1,3-butadiene and ethenylbenzene	25085-39-6	Not a PBT	No	No	Yes	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9. REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

AICS	Australian Inventory of Chemical Substances
CAS RN	Chemical Abstract Services Registry Number
COC	constituent of concern
DoEE	Department of the Environment and Energy
ECHA	European Chemicals Agency
EU	European Union
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
KI	Klimisch scoring system
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases

2,4,6-TRIDIMETHYLAMINOMETHYL PHENOL

This dossier on 2,4,6-tridimethylaminomethyl phenol presents the most critical studies pertinent to the risk assessment of 2,4,6-tridimethylaminomethyl phenol in its use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – 2,4,6-Tridimethylaminomethyl phenol is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

2,4,6-tridimethylaminomethyl phenol is a mannich base with industrial uses as a viscosity adjustor, hardener and catalyst (NCBI, 2026).

2,4,6-tridimethylaminomethyl phenol is not readily biodegradable. It will exist primarily in cation form in the environment and cations generally adsorb more strongly to soils containing organic carbon and clay than their neutral counterparts, indicating limited mobility. However, if released to water, based on its high water solubility, it is not expected to adsorb to suspended solids and sediment. It has a low potential for bioaccumulation.

The acute and chronic toxicity of 2,4,6-tridimethylaminomethyl phenol is of low concern to aquatic organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): 2,4,6-tris[(dimethylamino)methyl]phenol

CAS RN: 90-72-2

Molecular formula: $C_{15}H_{27}N_3O$

Molecular weight: 265.394 g/mol

Synonyms: 2,4,6-tridimethylaminomethyl phenol; phenol, 2,4,6-tris[(dimethylamino)methyl]-; TDMA-methylphenol

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of 2,4,6-Tridimethylaminomethyl phenol

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Pale yellow/straw liquid with amine odour	2	ECHA
Melting Point	-20°C @ 101.3 kPa	1	ECHA
Boiling Point	156°C @ 101.3 kPa	1	ECHA
Density	810 kg/m^3 @ 25 °C	2	ECHA
Vapor Pressure	0.075 Pa @ 25°C	1	ECHA
Partition Coefficient (log K_{ow})	-0.66 @ 21.5°C	1	ECHA
Water Solubility	850 g/L @ 20°C	1	ECHA
Dissociation constant (pKa)	9.79 @ 20°C	1	ECHA
Viscosity	200 mPa s @ 20°C	2	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for 2,4,6-tridimethylaminomethyl phenol.

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

2,4,6-tridimethylaminomethyl phenol is not readily biodegradable. It will exist primarily in cation form in the environment and cations generally adsorb more strongly to soils containing organic carbon and clay than their neutral counterparts, indicating limited mobility. However, if released to water, based on its high water solubility, it is not expected to adsorb to suspended solids and sediment. It has a low potential for bioaccumulation.

B. Partitioning

2,4,6-tridimethylaminomethyl phenol is highly soluble in water. Volatilisation from water is not expected to be an important fate process based upon its Henry's Law Constant (3.47 x 10^{-7} Pa m^3/mol) (ECHA). The estimated pKas of 2,4,6-tridimethylaminomethyl phenol are estimated as 8.41, 9.12 and 9.75 for the three amine groups and 10.4 for the hydroxyl group, which indicates that the substance will exist primarily in cation form in the environment and cations generally adsorb more strongly to soils containing organic carbon and clay than their neutral counterparts. Volatilisation from moist soil is not expected because cations do not volatilize. It is also not expected to volatilise from dry soil surfaces based upon its estimated vapour pressure (0.075 Pa) (NCBI, 2026).

C. Biodegradation

2,4,6-tridimethylaminomethyl phenol is not expected to be readily biodegradable. In a test according to OECD 301D (Ready Biodegradability: Closed Bottle Test), the substance attained 4% degradation after 28 days based on oxygen consumption (ECHA) [KI. Score = 1].

If a chemical is found to be not readily biodegradable, it is categorised as Persistent since its half-life is substantially greater than 60 days (DoEE, 2017).

D. Environmental Distribution

No experimental data are available for 2,4,6-tridimethylaminomethyl phenol. Using KOCWIN in EPISUITE™ (USEPA, 2019), the estimated soil organic carbon partition coefficient (K_{oc}) value from the molecular connectivity index (MCI) and log K_{ow} are 1,483 and 20.98 L/kg, respectively (ECHA) [KI. Score = 2].

Based on the upper end K_{oc} value, if released to soil, 2,4,6-tridimethylaminomethyl phenol is expected to strongly adsorb in soil and have limited mobility which is consistent with its presence as a cation in the environment. However, if released to water, with its high water solubility (850 g/L), it is not expected to adsorb to suspended solids and sediment (NCBI, 2026).

E. Bioaccumulation

In accordance with column 2 of Annex IX 9.3.2 of REACH Regulation EC 1907/2006 (ECHA), bioaccumulation testing in aquatic species is not required if the substance has a low potential for bioaccumulation (log K_{ow} of < 3).

The log K_{ow} for 2,4,6-tridimethylaminomethyl phenol is -0.66 (ECHA). Thus, 2,4,6-tridimethylaminomethyl phenol is not expected to bioaccumulate.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

The acute and chronic toxicity of 2,4,6-tridimethylaminomethyl phenol is of low concern to aquatic organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on 2,4,6-tridimethylaminomethyl phenol.

Table 3: Acute Aquatic Toxicity Studies on 2,4,6-Tridimethylaminomethyl Phenol

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Cyprinus carpio (Carp)	96-hr LC_{50}	>100	1	ECHA
Oncorhynchus mykiss (Rainbow trout)	96-hr LC_{50}	>180	-	NCBI, 2026
Daphnia magna (Water flea)	48-hr EC_{50}	>100	1	ECHA
Raphidocelis subcapitata (Green alga)	72-hr EC_{50}	46.7 (growth)	1	ECHA

Chronic Studies

No chronic studies were available for fish and algae. The substance is highly soluble in water (>850 g/L) and therefore long-term aquatic toxicity testing on fish and invertebrates is not indicated (ECHA).

A 72-hour NOEC of 6.44 mg/L and EC10 of 25.1 mg/L was determined for *Raphidacelis subcapitata* (green alga) based on growth (ECHA). [Kl. score = 1].

C. Terrestrial Toxicity

No studies were available for 2,4,6-tridimethylaminomethyl phenol.

According to Regulation (EC) No.1907/2006, Annex IX, Column 2, and Annex X, Column 2, studies on effects on terrestrial organisms (including soil macroorganisms, terrestrial plants, soil microorganisms and birds) do not need to be conducted if direct and indirect exposure of the soil compartment is unlikely (ECHA).

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

The substance 2,4,6-tridimethylaminomethyl phenol is not readily biodegradable, and thus does meet the screening criteria for persistence.

Based on a measured log K_{ow} of -0.66, 2,4,6-tridimethylaminomethyl phenol does not meet the screening criteria for bioaccumulation.

The lowest chronic NOEC for 2,4,6-tridimethylaminomethyl phenol in algae is > 0.1 mg/L. The acute $E(L)C_{50}$ values in fish, invertebrates and algae are >1 mg/L. Thus, 2,4,6-tridimethylaminomethyl phenol does not meet the screening criteria for toxicity.

The overall conclusion is that 2,4,6-tridimethylaminomethyl phenol is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for 2,4,6-tridimethylaminomethyl phenol.

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8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
2,4,6-Tridimethylaminomethyl phenol	90-72-2	Not a PBT	No	No	Yes	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

Department of the Environment and Energy [DoEE]. (2017). Chemical Risk Assessment Guidance Manual: for chemicals associated with coal seam gas extraction, Guidance manual prepared by Hydrobiology and ToxConsult Pty Ltd for the Department of the Environment and Energy, Commonwealth of Australia, Canberra. Available: www.environment.gov.au/water/coal-and-coal-seam-gas/national-assessment-chemicals/consultation-risk-assessment-guidance-manual

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B. Abbreviations and Acronyms

%	percent
°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
BCF	bioconcentration factor
COC	constituent of concern
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union

g/L	grams per litre
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
Kl	Klimisch scoring system
K_{oc}	organic carbon-water partition coefficient
K_{ow}	octanol water partition coefficient
kPa	kilopascal
L	litre
L/kg	litres per kilogram
LC	lethal concentration
m^3	cubic metre
MCI	molecular connectivity index
mg/L	milligrammes per litre
mL	millilitre
mPa s	millipascal second
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
pKa	acid dissociation constant
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

TRIAZINE

This dossier on triazine presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): 1,3,5-Triazine

CAS RN: 290-87-9

Molecular formula: $C_3H_3N_3$

Molecular weight: 81.08 g/mol

Synonyms: triazine; s-triazine

SMILES: C1=NC=NC=N1

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of triazine

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	Pale, yellow liquid	-	SDS
Melting Point	86°C @ 101.3 kPa	-	USEPA, 2026
Boiling Point	114°C @ 101.3 kPa	-	USEPA, 2026
Density	1,150 kg/m^3@ 25°C (QSAR)	-	USEPA, 2026
Vapour Pressure	1,719.98 Pa @ 25°C (QSAR)	-	USEPA, 2026
Partition Coefficient (log K_{ow})	-0.163 (temperature not provided)	-	USEPA, 2026
Water Solubility	659.16 g/L (temperature not provided) (QSAR)	-	USEPA, 2026
Flash Point	31.2°C	-	USEPA, 2026
Auto flammability	Not available	-	-
Viscosity	Not available	-	-
Henry's Law Constant	0.625 Pa m^3/mol (temperature not provided) (QSAR)	-	USEPA, 2026

III. ENVIRONMENTAL FATE PROPERTIES

A. Summary

Triazine is readily biodegradable, is not expected to bioaccumulate, and has a low potential to adsorb to soil or sediment.

B. Biodegradation

In the safety data sheet for OVA TRICIDE 70 (70-80% triazine), triazine is reported to be readily biodegradable. This is consistent with a quantitative structure activity relationship (QSAR) model (OPERA Model Ready Binary Biodegradability test), where triazine was classified as readily biodegradable (USEPA, 2026).

If a chemical is found to be readily or inherently biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

No experimental data is available. Using KOCWIN in EPISUITE™ (USEPA, 2019), the estimated soil organic carbon partition coefficient (K_{oc}) value for triazine from log K_{ow} is 7.371 L/kg. The estimated K_{oc} value from the molecular connectivity index (MCI) is 86.7 L/Kg.

If released to soil, based on these K_{oc} values, the substance is expected to not strongly sorb to soils and be highly mobile. If released to water, based on the K_{oc} values and water solubility, it is expected to have limited adsorption to suspended solids and sediment and preferentially partition to the water column.

D. Bioaccumulation

Based on an experimental log K_{ow} of -0.163 and a calculated bioconcentration factor (BCF) of 1.66 L/kg (USEPA, 2026), the potential for bioaccumulation is low.

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

Limited toxicity data was available for triazine; therefore, the human health assessment relies on read-across data for 1,3,5-triazine-1,3,5(2H,4H,6H)-triethanol (CAS RN 4719-04-4). Based on these substances, triazine was moderately acutely toxic by oral and inhalation routes of exposure, but non-toxic following dermal application. It did not cause skin irritation and was only slightly irritating to the eye. It was a skin sensitiser. In repeated-dose oral, inhalation, and dermal toxicity studies, this material is a systemic toxicant but was not a reproductive or developmental toxicant. It is not genotoxic. Carcinogenic studies were not available.

B. Acute Toxicity

Oral

In an oral acute toxicity study (OECD 401), groups of fasted Wistar rats (5 per sex) were given a single oral dose of 1,3,5-triazine-1,3,5(2H,4H,6H)-triethanol (500, 1000 or 2000 mg/kg bw. Four of five males and all females in the 2000 mg/kg bw dose group and 2/5 males and 4/5 females in the

1000 mg/kg bw dose group died within two days after administration. Necroscopy findings of the animals that died included agonal congestion, erythema, erosion in the glandular stomach and discolouration of the mucosa of the forestomach and the glandular stomach. Observed sub-lethal effects included general depressed activity, staggering, paresis and diarrhoea. The median lethal dose (LD50) was calculated as 763 mg/kg bw in rats (NICNAS,2016).

Inhalation

In the acute inhalation toxicity study (OECD 403), groups of Wistar rats (5 per sex) were exposed for four hours to either 0.257, 0.485 or 1.068 mg/L of 1,3,5-triazine-1,3,5(2H,4H,6H)-triethanol as an aerosol. Two of five females and 1/5 male died at 0.257 mg/L. Three of five females and 3/5 males died at 0.485 mg/L. At 1.068 mg/L all animals died or were euthanised in a moribund state. Lethality was observed either during exposure or shortly after exposure on days 0 to 2. Reported signs of toxicity included breathing difficulties. Recovery immediately post exposure was poor as there was little return of the respiration frequency towards the control levels. The chemical has high acute toxicity following inhalation exposure based on results from animal tests. The median lethal concentration (LC50) in rats is 371 mg/m^3 (NICNAS, 2016).

Dermal

In an acute dermal toxicity study (OECD 402), Wistar rats (5 per sex) was administered a dose of 1,3,5-triazine-1,3,5(2H,4H,6H)-triethanol at 4000 mg/kg bw. The chemical was applied to the clipped epidermis of each animal and was covered by a semi-occlusive dressing for 24 hours. The animals were then observed for 14 days. No mortality was observed in the study. No systemic pathologic findings were noted at necroscopy of animals euthanised at the end of the study. Local effects such as varying severity of erythema, slight oedema, scaling and superficial scabbing were observed. The chemical has low acute toxicity based on results from an animal test following dermal exposure. The LD50 in rats in this study was >4000 mg/kg bw (NICNAS, 2016).

C. Irritation

Skin

In a dermal irritation study (OECD 404), New Zealand White rabbits were exposed dermally to 0.5 mL of 1,3,5-triazine-1,3,5(2H,4H,6H)-triethanol for four hours via a test patch moistened with the substance (REACH). No local effects were observed in any of the animals. The study was subsequently terminated 72 hours after the removal of the patches. Under the test conditions, the chemical did not cause irritation to the skin (NICNAS, 2016).

Eye

In a bovine corneal opacity and permeability test (OECD 437), three bovine corneas were treated with 750 µL of 1,3,5-triazine-1,3,5(2H,4H,6H)-triethanol for 10 minutes, followed by a post exposure period of two hours. The corneal opacity was measured quantitatively, by the amount of light transmission through the cornea. The measurements were used to calculate the in vitro irritancy score of the chemical relative to the untreated corneas. The scores indicated that the chemical did not cause serious damage to bovine corneas (NICNAS, 2016).

In an acute eye irritation study (OECD Guideline 405), 6 (sex unspecified) New Zealand White rabbits were administered 0.1 mL of 1,3,5-triazine-1,3,5(2H,4H,6H)-triethanol in the conjunctival sac of the right eye. The chemical was washed out of the eye 24 hours later and the eyes were examined for

signs of irritation at 1, 24, 48 and 72 hours, and further after 8, 15 and 21 days. There was slight iritis observed in all animals which was reversible within 8 days. No eye lesions remained in any of the test animals at the end of the three-week observation period (NICNAS, 2016).

D. Sensitisation

Skin

A guinea pig maximisation test was conducted in 19 female Dunkin-Hartley guinea pigs. Intradermal induction used 1 % of 1,3,5-triazine-1,3,5(2H,4H,6H)-triethanol in propylene glycol which was injected intracutaneously. Topical induction used 25% of the chemical in petrolatum occlusively. The animals were challenged with 0.1 %, 0.5 % or 1 % of the chemical in petrolatum epicutaneously. Control animals were also exposed to the test chemical at the same concentrations at challenge. The number of sensitised animals at 48 hours after challenge on day 21 was as follows: 0.1 % - 1/19; 0.5 % - 13/19; 1.0% - 19/19. The substance was considered to be a skin sensitiser (NICNAS, 2016).

In an open epicutaneous study, groups of guinea pigs were administered 100 µL of 1 % of 1,3,5-Triazine-1,3,5(2H,4H,6H)-triethanol to an 8-cm² area of the right flank skin, once daily on working days (5/wk) for four weeks at 15 %, 4 %, 0.4 % or 0.15 %. The control group animals were not treated. Skin readings were performed 24 h after application. Three days after the last induction treatment, test group animals and control group animals were challenged with 25 µL of each of 4 different concentrations (15 %, 4 %, 1.5 % or 0.4 %) to a 2-cm² area on the previously untreated flank. Skin reactions were read at 24, 48 and 72 h after application of the solutions. The second challenge treatment was performed 17 days after the last induction treatments. The test was positive if at least one guinea pig of the particular concentration group exhibited positive skin reactions with a non-irritant concentration 24, 48 or 72 h after application of the test substance with the control animals showing a negative reaction. Under the experimental conditions of this study, the test substance was sensitising at challenge with concentrations of 0.4 % and above. The test substance was considered a skin sensitiser (NICNAS, 2016).

E. Repeated Dose Toxicity

Oral

In a repeated dose oral toxicity 90-day study conducted according to the OECD TG 442, 1,3,5-triazine-1,3,5(2H,4H,6H)-triethanol was administered to Wistar CrIGlxBrIHan rats (10/sex/dose) at dietary concentrations of 200 ppm (14 mg/kg bw/day in males; 21 mg/kg bw/day in females), 1000 ppm (64 mg/kg bw/day in males; 91 mg/kg bw/day in females), and 5000 ppm (285 mg/kg bw/day in males; 339 mg/kg bw/day in females). The animals were observed for signs of toxicity or mortality up to twice a day for 3 months. At the end of the study, neither mortality nor clinical symptoms of toxicity were observed, and the appearance and behaviour of the animals showed no treatment related changes. The no observed adverse effect level (NOAEL) was >285 and >339 mg/kg bw/day in male and female rats, respectively (NICNAS, 2016).

Inhalation

In a repeated dose inhalation toxicity study (OECD 412), Wistar rats (10 animals per sex per dose) were exposed (nose only) to the aerosol chemical at 3, 10, 30 and 100 mg/m³. The highest concentration was decreased to 50 mg/m³ after the first exposure day for females and the second exposure day for males due to clinical signs indicative of a severe irritant response. The animals were exposed for 6 hrs/day for 5 consecutive days per week for 4 weeks. The target concentrations were maintained throughout the exposure period. Severe clinical signs of toxicity (gasping, intermittent

respiration, respiration sound, red encrusted nose, hypothermia, poor general state and yellow discoloured fur), significantly reduced body weight change in males and premature death of 5 of the 10 males were observed in the highest dose group (initially 100 mg/m³, then lowered to 50 mg/m³). In the 30 mg/m³ and 10 mg/m³ groups, intermittent respiration, rales, red encrusted nose, squamous metaplasia occurred in all treated groups. The presence of erosion/ulceration of the larynx, squamous metaplasia of the nasal cavity, squamous metaplasia of the carina epithelium, necrosis of the u-shaped cartilage of the larynx, epithelial hyperplasia of the larynx and degeneration of the bronchial epithelium for both sexes were noted. In the lowest dose group (3 mg/m³): multifocal squamous metaplasia of the larynx in all animals; necrosis of the u-shaped cartilage of the larynx in 1/10 males; degeneration of the bronchial epithelium in 3/10 males and 7/10 females and squamous metaplasia of the carina epithelium in 4/10 males and 3/10 females were noted (REACH). In conclusion, exposure of male and female Wistar rats to the aerosol of the chemical caused concentration-related local irritation of the respiratory tract. Systemic toxicity was not observed in clinical chemistry, haematology or in histological examinations up to 30 mg/m³. The reduced body weight gain and premature death were associated with the severe local irritation. Based on histopathology findings in larynx, trachea and lung, a no observed adverse effect concentration (NOAEC) could not be established for the local irritation effect under the current study conditions. For systemic effects the NOAEC is 30 mg/m³ (NICNAS, 2016).

Dermal

In a subchronic dermal toxicity 90-day study, male and female Charles River rats (10 animals per sex per dose) were treated with 1,3,5-Triazine-1,3,5(2H,4H,6H)-triethanol under semi-occlusive conditions for 6 hours/day, 5 days/week for 90 days. Doses were 0, 5, 50 or 250 mg/kg bw/day. The application site was not washed between doses. No mortality occurred during the test. There was no treatment related clinical signs. Yellow staining at the site of application in the 50 and 250 mg/kg bw/day groups was seen. The NOAEL was >250 mg/kg bw/day (NICNAS, 2016).

F. Genotoxicity

Based on the weight of evidence from the available data, the chemical is not considered to be genotoxic (NICNAS, 2016).

In Vitro Studies

The *in vitro* genotoxicity studies on 1,3,5-triazine-1,3,5(2H,4H,6H)-triethanol are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on 1,3,5-Triazine-1,3,5(2H,4H,6H)-triethanol

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Chromosome aberration test with Chinese hamster lung fibroblasts	+	+	—	NICNAS, 2016
Bacterial mutation tests	-	-	—	NICNAS, 2016
Mammalian cell gene mutation test using Chinese hamster lung fibroblasts	-	-	—	NICNAS, 2016
Unscheduled DNA synthesis test with rat liver cell	-		—	NICNAS, 2016

*+, positive; -, negative

In Vivo Studies

Negative results were obtained in a chromosomal aberration test in rats.

Negative results were obtained in two erythrocyte micronucleus tests in mice.

G. Carcinogenicity

Oral

No studies are available.

Inhalation

No studies are available.

Dermal

In a poorly documented dermal study with a limited number of animals, 1,3,5-triazine-1,3,5(2H,4H,6H)-triethanol was applied to a shaved area of the upper part of the back of NMRI mice. Applications, 0.15%, 1.5 % and 15% of the chemical (purity not specified) were made three times a week, over 31 consecutive weeks. All mice survived to the end of the study. Slight dysplasia was reported in two high-dose animals. Hyperplasia occurred in one mid-dose and seven high-dose mice. Three of the high-dose animals had degenerative changes (amyloid deposition) in the kidney, but not the spleen or liver. The test substance did not induce papillomas. No information is provided on clinical observations in the treated animals (NICNAS, 2016).

H. Reproductive Toxicity

No studies are available.

I. Developmental Toxicity

Oral

In a prenatal developmental toxicity study in rats, artificially inseminated female Sprague-Dawley rats (24/group) were administered the aqueous chemical (78.5% 1,3,5-tris(2-hydroxyethyl)hexahydro-1,3,5-triazine) by gavage at doses of 0, 250, 500, and 750 mg/kg/day in deionised water on gestation days 6 through 15. All animals survived the duration of the study. High dose females exhibited post-dosing salivation. Rales, laboured breathing, wheezing, and tachypnoea were observed occasionally in the mid and high dose groups toward the end of the dosing period. No other clinical signs were reported. Maternal body weight gain and food consumption were significantly lower in the high dose females during the dosing period than the controls. Stomach lesions, characterised by ulceration and/or scarring of the mucosa, were observed in 14 of 20 high dose females. No gross abnormalities were reported in the other dosage groups. No differences were seen between the control and treated dams with respect to pregnancy rates, number of corpora lutea, implantation sites, number of live foetuses, or early and late resorptions. There were no abortions and no premature deliveries. At these doses, developmental toxicity as measured by foetal pup weight, external, or visceral, abnormalities were not seen. There were increased incidences of vestigial 14th ribs and retarded ossification of the vertebral thoracic centra which appeared to be dose related. The effects were not statistically significant, and the incidence of these abnormalities is highly variable in rats, they are not considered treatment related. The maternal

NOAEL is 500 mg/kg bw/day, based on decreased body weight gain, ulcerations and/or scarring of the stomach mucosa at the higher dose. The NOAEL for developmental toxicity is 750 mg/kg bw/day (NICNAS, 2016).

Inhalation

No data available

Dermal

No data available

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for triazine follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

A. Non-Cancer

Oral

The lowest NOAEL from these studies is 500 mg/kg bw/day based on maternal decreased body weight gain, ulcerations and/or scarring of the stomach mucosa at the higher dose in a developmental toxicity study. The NOAEL of 500 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:

UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 10
UF_D (database uncertainty) = 1
Oral RfD = 500/(10 x 10 x 1 x 10 x 1) = 500/1000 = 0.5 mg/kg/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

Where:

Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)
Drinking water guidance value = (0.5 x 70 x 0.1)/2 = 1.8 mg/L

B. Cancer

Based on the weight of evidence from the available data, read-across substance 1,3,5-triazine-1,3,5(2H,4H,6H)-triethanol is not considered to be genotoxic. There was no data available for the carcinogenic potential of triazine or its read-across substance. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Triazine does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Triazine is expected to have low acute and chronic toxicity to aquatic organisms and low acute toxicity to terrestrial organisms.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies conducted on triazine and read-across substance 1,3,5-triazine-1,3,5(2H,4H,6H)-triethanol.

Table 3: Acute Aquatic Toxicity Studies on Triazine

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Oncorhynchus mykiss (Rainbow trout)	96-hr LC_{50}	>119*		NCBI, 2026
Daphnia magna	48-hr EC_{50}	26.1*		NCBI, 2026
Raphidocelis subcapitata (Green alga)	48-hr EC_{50}	239 a.i. (growth)	-	ECOTOX

Note: a.i. = active ingredient
*Read-across substance

Chronic Studies

No chronic studies were available for fish or invertebrates for triazine or read-across substance 1,3,5-triazine-1,3,5(2H,4H,6H)-triethanol.

In *raphidocelis subcapitata* (green alga), a 48-hr EC_{10} value of 99 mg/L based on growth was reported for triazine (ECOTOX).

C. Terrestrial Toxicity

No studies were available for triazine.

Studies on effects on terrestrial organisms (birds) were available read-across substance 1,3,5-triazine-1,3,5(2H,4H,6H)-triethanol. 8-Day LC50 values were reported for *Colinus virginianus* (bobwhite quail) and *Anas platyrhynchos* (mallard duck) ranging between 5,000 PPM and 5,620 PPM (NCBI, 2026).

D. Calculation of PNEC

The PNEC calculations for triazine follow the methodology discussed in DEWHA (2009).

PNEC Water

Experimental results are available for three trophic levels. Acute $E(L)C_{50}$ values are available for fish (119 mg/L), invertebrates (26.1 mg/L) and algae (239 mg/L). An EC_{10} value from a long-term study is available for algae (99 mg/L). On the basis that the data consists of short-term results from three trophic levels and long-term results from one trophic level, an assessment factor of 100 has been applied to the EC_{10} value of 99 mg/L for algae. The $PNEC_{water}$ is 0.99 mg/L.

PNEC Sediment

There are no toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 0.73 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (0.9415/1280) \times 1000 \times 0.99$
$= 0.73$ mg/kg

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]
$K_{sed\text{-}water} = 0.8 + [(0.2 \times Kp_{sed})/1000 \times BD_{solid}]$
$= 0.8 + [(0.2 \times 0.2948/1000 \times 2400]$
$= 0.9415\ m^3/m^3$

Where:
Kp_{sed} = solid-water partition coefficient (L/kg)
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]
$Kp_{sed} = K_{oc} \times f_{oc}$
$= 7.371 \times 0.04$
$= 0.2948$ L/kg

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The estimated K_{oc} value from the log K_{ow} method in EPISUITE is 7.371 L/Kg.

F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC Soil

There is limited toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 0.097 mg/kg soil dry weight.

The calculations are as follows:

$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$

$= (0.1474/1500) \times 1000 \times 0.99$

$= 0.0973$ mg/kg

Where:

Kp_{soil} = soil-water partition coefficient (m^3/m^3)

BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]

$Kp_{soil} = K_{oc} \times f_{oc}$

$= 7.371 \times 0.02$

$= 0.1474\ m^3/m^3$

Where:

K_{oc} = organic carbon normalised distribution coefficient (L/kg). The estimated K_{oc} value from the log K_{ow} method in EPISUITE is 7.371 L/Kg.

F_{oc} = fraction of organic carbon in soil = 0.02 [default].

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (IChEMS, 2022; ECHA, 2023).

Triazine is reported to be readily biodegradable; and, thus does not meet the screening criteria for persistence.

Based on an experimental log K_{ow} of -0.163 and a calculated bioconcentration factor (BCF) of 1.66 L/kg; triazine does not meet the criteria for bioaccumulation.

The NOEC values from chronic aquatic toxicity studies on algae are > 0.1 mg/L. The acute $E(L)C_{50}$ values for triazine and read-across substance are also > 1 mg/L. Thus, triazine does not meet the criteria for toxicity.

The overall conclusion is that triazine is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Acute Toxicity (oral) Category 4

Skin Corrosion Category 1B

Skin Irritation Category 2

Eye Damage Category 1

Specific Target Organ Toxicity – Single Exposure Category 3

Reproductive Toxicity Category 1B

B. Labelling

Danger

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information..

B. Fire Fighting Information

Not specified.

C. Accidental Release Measures

Not specified.

D. Storage And Handling

Not specified.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

A workplace exposure standard for triazine has not been established in Australia.

Engineering Controls

Not specified.

Personal Protection Equipment

Not specified.

F. Transport Information

Triazine is not considered hazardous for purposes of transportation by road or rail. An Australian Dangerous Goods code is not required.

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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2,2',2''-(HEXAHYDRO-1,3,5-TRIAZINE-1,3,5-TRIYL)TRIETHANOL

This dossier on 2,2',2''-(hexahydro-1,3,5-triazine-1,3,5-triyl)triethanol (also known as triazinetriethanol) presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Triazinetriethanol was not identified in chemical databases used by NICNAS as an indicator that the chemical is of concern and is not a PBT substance. Triazinetriethanol was assessed as a tier 2 chemical for acute toxicity and as a tier 1 chemical for chronic toxicity. Therefore, this substance is classified overall as a **tier 2** chemical and requires a hazard assessment and qualitative assessment of risk.

1 BACKGROUND

Triazinetriethanol is readily biodegradable; is not expected to bioaccumulate; and has low potential to adsorb to soil and sediment.

The acute toxicity of triazinetriethanol is low to moderate by the oral and dermal routes, and high by the inhalation route. It is irritating to the eyes, but not the skin. Triazinetriethanol is a skin sensitiser. Repeated dose toxicity studies showed no target organ effects by the oral and dermal routes; inhalation exposure caused effects to the respiratory tract that were indicative of irritating response. Triazinetriethanol is not genotoxic. There were no developmental effects when pregnant female rats were dosed by oral gavage with triazinetriethanol; fetotoxicity was observed at oral doses that were toxic to pregnant female rabbits.

Triazinetriethanol has a moderate acute toxicity concern to aquatic organisms. Direct exposure to the terrestrial compartment is unlikely.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): 2,2',2''-(1,3,5-triazinane-1,3,5-triyl)triethanol

CAS RN: 4719-04-4

Molecular formula: $C_9H_{21}N_3O_3$

Molecular weight: 219.28 g/mol

Synonyms: triazinetriethanol; 2,2',2''-(hexahydro-1,3,5-triazine-1,3,5-triyl)triethanol; 2,2',2''-(1,3,5-triazinane-1,3,5-triyl)triethanol; 1,3,5-triazine-1,3,5(2H,4H,6H)-triaethanol; 1,3,5-triazine-1,3,5-triazinethanol; hexahydro-1,3,5-tris(hydroxyethyl)triazine; hexahydro-1,3,5-tris-(-2-hydroxyethyl)-s-triazine; Grotan; Grotan BK ; Myaside HT

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of triazinetriethanol

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Liquid	1	ECHA
Melting Point	-79°C @ 101.3 kPa	1	ECHA
Boiling Point	110.1°C @ 101.3 kPa	1	ECHA
Density	1155 kg/m^3 @ 20 °C	1	ECHA
Vapor Pressure	0 Pa @ 25°C	1	ECHA
Partition Coefficient (log K_{ow})	-2.0 @ 24°C	1	ECHA
Water Solubility	Miscible	1	ECHA
Dissociation constant (pKa)	Not available	-	-
Viscosity	Not available	-	-

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for triazinetriethanol.

In an AICIS evaluation statement, triazinetriethanol was determined to be a chemical that is unlikely to require further regulation to manage risks to the environment.[1]

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

[1] https://cdnservices.industrialchemicals.gov.au/statements/EVA00164%20-%20Evaluation%20Statement%20-%2016%20December%202024.pdf

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Triazinetriethanol is readily biodegradable; is not expected to bioaccumulate; and has low potential to adsorb to soil and sediment.

B. Biodegradation

Triazinetriethanol is readily biodegradable. In an OECD 301 A test, there was >90% to <100% degradation after 8 days (ECHA) [Kl. score = 1].

C. Environmental Distribution

No experimental data are available for triazinetriethanol. Using KOCWIN in EPISUITE™ (USEPA, 2019), the estimated K_{oc} value from log K_{ow} is 0.5852 L/kg. The estimated K_{oc} value from the molecular connectivity index (MCI) is 1.167 L/kg.

D. Bioaccumulation

There are no bioaccumulation studies on triazinetriethanol. Triazinetriethanol is not expected to bioaccumulate based on a log Kow of -2.0 (ECHA).

6 HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

The acute toxicity of triazinetriethanol is low to moderate by the oral and dermal routes, and high by the inhalation route. It is irritating to the eyes, but not the skin. Triazinetriethanol is a skin sensitiser. Repeated dose toxicity studies showed no target organ effects by the oral and dermal routes; inhalation exposure caused effects to the respiratory tract that were indicative of irritating response. Triazinetriethanol is not genotoxic. There were no developmental effects when pregnant female rats were dosed by oral gavage with triazinetriethanol; fetotoxicity was observed at oral doses that were toxic to pregnant female rabbits.

B. Acute Toxicity

Oral

The oral LD_{50} values in rats is approximately 1,000 mg/kg (ECHA) [Kl. score = 1].

Dermal

The dermal LD_{50} value in rats is >4,000 mg/kg (ECHA) [Kl. score = 1].

Inhalation

The 4-hour inhalation (nose-only) LC_{50} value of an aerosol of triazinetriethanol to rats is 0.0371 mg/L. The mass median aerodynamic diameters (MMADs) were between 1.6 and 1.9 μm (ECHA) [Kl. score = 1].

C. Irritation

Triazinetriethanol is not irritating to the skin of rabbits; but it is irritating to the eyes of rabbits (ECHA) [Kl. score = 1].

D. Sensitisation

Triazinetriethanol was considered to be a dermal sensitiser in a mouse local lymph node assay (ECHA) [Kl score = 1].

E. Repeated Dose Toxicity

Oral

Male and female Wistar rats were in their drinking water 0, 200, 1,000, or 5,000 ppm triazinetriethanol for 90 days. The average daily intakes are: 0, 14, 64, and 285 mg/kg-day for males; and 0, 21, 91, and 339 mg/kg-day for females. There were no treatment-related clinical signs or mortality. Body weights were significantly lower in the 5,000 ppm males during the entire treatment period. Feed and water consumption were significantly reduced in the 5,000 ppm males and females during the entire treatment period. At the end of the study, the 5,000 ppm animals produced decreased amounts of urine with increased specific gravity. Estrous cycle determination in the females and sperm analysis in the males showed no treatment-related effects. Neurobehavior was unaffected by treatment. Kidney weights were significantly increased in the 5,000 ppm females. Brain and adrenal gland weights were increased in the 5,000 ppm males. Histopathological examination showed no treatment-related changes. The NOAEL is 1,000 ppm, which corresponds to 64 and 91 mg/kg-day for males and females, respectively (ECHA) [Kl. score = 1]

Inhalation

Male and female Wistar rats were exposed nose-only to 0, 3, 10, 30, or 100 mg/m^3 triazinetriethanol 6 hours/day, 5 days/week for 28 days (20 exposures). Due to severe clinical findings and premature deaths in the 100 mg/m^3 group, the exposure concentration was reduced to 50 mg/m^3. The MMADS were between 2.1 and 2.7 μm. The calculated mass fractions of particles below 3 μm aerodynamic size ranged between 56.6% and 70.7%. Clinical signs were noted in the ≥30 mg/m^3 groups. Mean body weights were not significantly different from the exposed and control groups. Body weight gain was significantly lower in the 100/50 mg/m^3 males from study day 0 to 4 only. Treatment-related findings of note were seen in the larynx (all exposure concentrations), nasal cavity (levels I and II), and trachea. These changes were considered to be the consequence of irritant effects of the test substance. Degeneration of the bronchial epithelium was also seen and was considered adverse as this could impair ciliary clearance from the lung. The NOAEC for systemic effects is 30 mg/m^3. The LOAEC for localized irritation is 3 mg/m^3; a NOAEC was not determined (ECHA) [Kl. score = 1].

Dermal

Male and female CD(SD)BR (VAF plus) rabbits were given dermal applications of 0, 5, 50, or 250 mg/kg triazinetriethanol 6 hours/day, 5 days/week for 90 days. There were no treatment-related clinical signs of note. Body weights, body weight gain, feed consumption, ophthalmoscopic examination, hematology, and urinalysis were similar between treated and control animals. There were no differences in clinical chemistry parameters, organ weights, gross pathology or histopathology (except at the application site) that were considered to be biologically significant or related to test material administration. The NOAEL for systemic toxicity is 250 mg/kg-day, the highest dose tested (ECHA) [Kl. score = 2].

F. Genotoxicity

In Vitro Studies

The *in vitro* genotoxicity studies on triazinetriethanol are presented below in Table 3.

Table 3: In vitro Genotoxicity Studies on Triazinetriethanol

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
Bacterial reverse mutation (S. typhimurium and E. coli strains)	-	-	1	ECHA
Mammalian cell gene mutation (Chinese hamster fibroblasts cells, V79)	-	-	1	ECHA
Chromosomal aberration (Chinese hamster fibroblasts cells, V79)	+	+	1	ECHA

*+, positive; -, negative

In Vivo Studies

Male NMRI mice were given intraperitoneal doses of triazinetriethanol on two consecutive days. The doses were equivalent on both days, with the total dosage being 0, 37.5, 75, and 150 mg/kg. There were no significant increases in the frequency of micronucleated polychromatic erythrocytes in the treated mice compared to the controls (ECHA) [Kl. score = 1].

In an unscheduled DNA synthesis test, male and female Wistar rats were dosed by oral gavage with 0, 375, and 750 mg/kg triazinetriethanol for the males and 0, 250, and 500 mg/kg triazinetriethanol. There was no evidence of genotoxicity (ECHA) [Kl. score = 1].

G. Carcinogenicity

No data are available.

H. Reproductive and Developmental Toxicity

Pregnant female SD rats were dosed by oral gavage with 0, 250, 500, or 750 mg/kg triazinetriethanol on GD 6-15. One high-dose female was killed on GD 14 because of poor clinical conditions. Treatment-related clinical signs were noted in the ≥500 mg/kg animals. Mean body weight gain and feed consumption were significantly reduced in the 750 mg/kg females. Stomach lesions occurred in

14/24 of the 750 mg/kg females. There were no development effects that were considered to be treatment-related. The NOAELs for maternal and developmental effects are 500 and 750 mg/kg-day, respectively (ECHA) [Kl. score = 1].

Pregnant female New Zealand White rabbits were dosed by oral gavage with 0, 20, 60, or 180 mg/kg triazinetriethanol on GD 6-28. Body weights and body weight gain were significantly reduced in the 180 mg/kg females. Mean fetal body weights were slightly, but statistically significantly, lower in the 180 mg/kg group compared to the controls. There were no other developmental effects noted that were treatment-related. The NOAEL for maternal and developmental toxicity is 60 mg/kg-day (ECHA) [Kl. score = 1].

I. Derivation of Toxicological Reference and Drinking Water Guidance Values

The toxicological reference values developed for triazinetriethanol follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2011).

Non-Cancer

The lowest NOAEL from these studies is 64 mg/kg bw/day based on a 90-day drinking water study in rats. The NOAEL of 64 mg/kg bw/day will be used for determining the oral Reference dose (RfD) and the drinking water guidance value.

Oral Reference Dose (oral RfD)

Oral RfD = NOAEL / (UF_A x UF_H x UF_L x UF_{Sub} x UF_D)

Where:
UF_A (interspecies variability) = 10
UF_H (intraspecies variability) = 10
UF_L (LOAEL to NOAEL) = 1
UF_{Sub} (subchronic to chronic) = 3
UF_D (database uncertainty) = 1

Oral RfD = 64/(10 x 10 x 1 x 3 x 1) = 64/300 = 0.2 mg/kg bw/day

Drinking water guidance value

Drinking water guidance value = (animal dose) x (human weight) x (proportion of intake from water) / (volume of water consumed) x (safety factor)

Using the oral RfD,

Drinking water guidance value = (oral RfD) x (human weight) x (proportion of water consumed) / (volume of water consumed)

where:
Human weight = 70 kg (ADWG, 2011)
Proportion of water consumed = 10% (ADWG, 2011)
Volume of water consumed = 2L (ADWG, 2011)

Drinking water guidance value = (0.2 x 70 x 0.1)/2 = 0.7 mg/L

Cancer

There are no carcinogenicity studies on triazinetriethanol; thus, a cancer reference value was not derived.

J. Human Health Hazard Assessment of Physico-Chemical Properties

Triazinetriethanol does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

7 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Triazinetriethanol has a moderate acute toxicity concern to aquatic organisms. Direct exposure to the terrestrial compartment is unlikely.

B. Aquatic Toxicity

Acute Studies

Table 4 lists the results of acute aquatic toxicity studies conducted on triazinetriethanol.

Table 4: Acute Aquatic Toxicity Studies on triazinetriethanol

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
Brachydanio rerio	96-hr LC_{50}	16.07	1	ECHA
Daphnia magna	48-hr EC_{50}	11.9	1	ECHA
Desmodesmus subspicatus	72-hr EC_{50}	6.66	1	ECHA

Chronic Studies

No studies are available for fish and invertebrates.

In an OECD Guideline 201 (Alga, Growth Inhibition Test) study conducted on *Desmodesmus subspicatus* (green algae), a 72-hr NOEC of 1.56 mg/L (based on growth rate) was determined (ECHA). [Kl. Score = 1]

C. Terrestrial Toxicity

As direct exposure of the soil compartment is unlikely and because the substance is readily biodegradable, study on toxicity to terrestrial organisms is not mandatory (ECHA).

D. Calculation of PNEC

The PNEC calculations for triazinetriethanol follow the methodology discussed in DEWHA (2009).

PNEC water

Experimental results are available for three trophic levels. Acute E(L)C_{50} values are available for fish (16.07 mg/L), invertebrates (11.9 mg/L), and algae (6.66 mg/L). Chronic NOEC or EC10 values are available for algae (1.56 mg/L). On the basis that the data consist of short-term results from three trophic levels and long-term results from one trophic level, an assessment factor of 50 has been applied to the NOEC value of 1.56 mg/L from algae. The $PNEC_{water}$ is 0.031 mg/L.

PNEC sediment

There are no relevant toxicity data for sediment-dwelling organisms. Therefore, the $PNEC_{sed}$ was calculated using the equilibrium partitioning method. The $PNEC_{sed}$ is 0.02 mg/kg sediment wet weight.

The calculations are as follows:

$PNEC_{sed} = (K_{sed\text{-}water}/BD_{sed}) \times 1000 \times PNEC_{water}$
$= (0.82/1280) \times 1000 \times 0.031$
$= 0.02$

Where:
$K_{sed\text{-}water}$ = suspended matter-water partition coefficient (m^3/m^3)
BD_{sed} = bulk density of sediment (kg/m^3) = 1,280 [default]

$K_{sed\text{-}water} = 0.8 + [0.2 \times (Kp_{sed}/1000) \times BD_{solid}]$
$= 0.8 + [0.2 \times (0.05/1000) \times 2400]$
$= 0.82$

Where:
Kp_{sed} = solid-water partition coefficient (L/kg).
BD_{solid} = bulk density of the solid phase (kg/m^3) = 2,400 [default]

$Kp_{sed} = K_{oc} \times f_{oc}$
$= 1.167 \times 0.04$
$= 0.05$

Where:
K_{oc} = organic carbon normalized distribution coefficient (L/kg). The K_{oc} for triazinetriethanol based on the molecular connectivity index (MCI) is 1.167 L/kg (EPA, 2018).
F_{oc} = fraction of organic carbon in sediment = 0.04 [default].

PNEC soil

There are no toxicity data for terrestrial or soil organisms. Therefore, the $PNEC_{soil}$ was calculated using the equilibrium partitioning method. The $PNEC_{soil}$ is 0.0005 mg/kg soil dry weight.

The calculations are as follows:
$PNEC_{soil} = (Kp_{soil}/BD_{soil}) \times 1000 \times PNEC_{water}$
$= (0.02/1500) \times 1000 \times 0.031$
$= 0.0005$

Where:

Kp_{soil} = soil-water partition coefficient (m^3/m^3)
BD_{soil} = bulk density of soil (kg/m^3) = 1,500 [default]
$Kp_{soil} = K_{oc} \times f_{oc}$

$= 1.167 \times 0.02$
$= 0.02$

Where:
K_{oc} = organic carbon normalised distribution coefficient (L/kg). The K_{oc} for triazinetriethanol based on the molecular connectivity index (MCI) is 1.167 L/kg (EPA, 2018).
F_{oc} = fraction of organic carbon in soil = 0.02 [default].

8 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU Reach Criteria methodology (IChEMS, 2022; ECHA, 2023).

Triazinetriethanol is readily biodegradable; thus, it does not meet the screening criteria for persistence.

Based on a measured log K_{ow} of -2.0, triazinetriethanol does not meet the screening criteria for bioaccumulation.

There are no chronic aquatic toxicity studies on triazinetriethanol. The acute E(L)C50 values for triazinetriethanol are >1 mg/L for fish and invertebrates. Thus, triazinetriethanol does not meet the screening criteria for toxicity.

The overall conclusion is that triazinetriethanol is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for triazinetriethanol.

9 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity[2]	Chronic Toxicity[2]	
2,2',2''-(Hexahydro-1,3,5-triazine-1,3,5-triyl)triethanol	4719-04-4	Not a PBT	No	No	No	No	No	No	2	1	2

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 2 - Hazard Assessment and Qualitative Assessment Only. Develop toxicological profile and PNECs for water and soil and provide qualitative discussion of risk.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

10 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

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B. Abbreviations and Acronyms

°C	degrees Celsius
ADWG	Australian Drinking Water Guidelines

AICIS	Australian Industrial Chemicals Introduction Scheme
AICS	Australian Inventory of Chemical Substances
COC	constituent of concern
DEWHA	Department of the Environment, Water, Heritage and the Arts
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
HHRA	enHealth Human Risk Assessment
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
KI	Klimisch scoring system
KOCWIN™	USEPA organic carbon partition coefficient estimation model
kPa	kilopascal
L	litre
L/kg	litres per kilogram
LC	lethal concentration
LD	lethal dose
LOAEL	lowest observed adverse effect level
m^3	cubic metre
MCI	molecular connectivity index
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
mg/m^3	milligrams per cubic metre
mPa s	millipascal second
NICNAS	The National Industrial Chemicals Notification and Assessment Scheme
NOAEL	no observed adverse effect level
Pa	pascal
PBT	Persistent, Bioaccumulative and Toxic
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RfD	Reference Dose
SGG	Synthetic Greenhouse Gases
USEPA	United States Environmental Protection Agency

WALNUT HULLS
NUT HULLS
ALMOND HULLS
VEGETABLE FIBRE
WOOD FIBRE
FRUIT HULLS

This dossier on walnut hulls[1], nut hulls, almond hulls, vegetable fibre, wood fibre and fruit hulls presents the most critical studies pertinent to the risk assessment of these substance in their use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Walnut hulls, nut hulls, almond hulls, vegetable fibre, wood fibre and fruit hulls are classified as **tier 1** chemicals and require a hazard assessment only.

1 BACKGROUND

Walnut hulls, nut hulls, almond hulls, vegetable fibre, wood fibre and fruit hulls are used to control lost circulation in water oil base drilling fluids. They may be utilized intact or in pill form with fibrous flake material.

The predominant degradation pathway for woody materials in the environment is expected to be microbial decomposition, whereby extracellular enzymes secreted by bacteria and fungi breakdown or otherwise transform the biopolymers in plant cell walls. Such decomposition processes are ubiquitous in the environment and are an important part of the biogeochemical carbon cycle (DoEE, 2017a).

Woody materials that have not been chemically treated are not considered to be directly toxic to biota.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Not applicable

CAS RN: Not applicable

Molecular formula: Not applicable

Molecular weight: Not applicable

Synonyms: Not applicable

[1] Includes Walnut, Juglans regia, ext CAS RN 84012-43-1

3 PHYSICO-CHEMICAL PROPERTIES

Nut shells differ chemically. Walnut shells have approximately 10.6% extractives, 30.1% lignin, and 49.7% polysaccharides, whereas almond shells have 5.7% extractives, 28.9% lignin, and 56.1% polysaccharides. The polysaccharide composition of walnut and almonds as the glucose/xylose ratio is 1.12. Walnut and almond shells have a syringyl (S) and guaiacyl (G) lignin ratio of 1.6 and 1.0. Wood and vegetable fibres are natural composite structures in which cellulose fibrils are held together by lignin and hemicellulose. The major constituents of wood fibres are lignin, cellulose, hemicellulose, and extractives. Each of these components contributes to fibre properties, which ultimately impact product properties.

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 1). This chemical is not listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for walnut hulls, nut hulls, almond hulls, vegetable fibre, wood fibre and fruit hulls.

Based on an assessment of environmental hazards, NICNAS identified wood products (which contains wood fibre, walnut hulls, nut hulls and natural fibres) as a chemical of low concern to the environment (DoEE, 2017b). Chemicals of low concern are unlikely to have adverse environmental effects if they are released to the environment from coal seam gas operations.

Table 1 Existing International Controls

Convention, Protocol or Other International Control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Walnut hulls, nut hulls, almond hulls, vegetable fibre, wood fibre and fruit hulls are biodegradable, are not expected to bioaccumulate, and in the terrestrial environment are expected to become part of the organic carbon pool in the soil where it will act as an important physical and chemical constituent.

B. Biodegradation

Walnut hulls, nut hulls, almond hulls, vegetable fibre, wood fibre and fruit hulls are expected to degrade over time under typical environmental conditions.

Wood and other plant-based materials are biodegraded by bacteria and fungi, occasionally over very long time scales (i.e. 1 000 year), with wood being an important carbon source in terrestrial ecosystems (e.g. Blanchette 2000; Wetzel 2001). The rates of decay and the biochemical pathways involved in wood decay are dependent on the environment in which the wood occurs, with decomposition possible in both anoxic and oxic environments (DoEE, 2017a).

C. Environmental Distribution

Wood products distributed in the terrestrial environment are expected to become part of the organic carbon pool in the soil where it will act as an important physical and chemical constituent. The materials in this group are transportable into water bodies either through indirect pathways where they can be entrained in runoff, or direct pathways as a result of spillage. In the aquatic environment, wood products can be viewed as particulate organic matter and are expected to become part of the aquatic carbon cycle. Decay rates for wood products in aquatic ecosystems are highly variable, with woody materials degrading before they reach the sediments in some aquatic ecosystems and being preserved for centuries in others (DoEE, 2017a).

D. Bioaccumulation

Nut shells are not bioaccumulative.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Walnut hulls, nut hulls, almond hulls, vegetable fibre, wood fibre and fruit hulls are of low acute toxicity concern to aquatic organisms.

Woody materials that have not been chemically treated are not considered to be directly toxic to biota. Nevertheless, organic matter such as woody materials can act as non-toxic stressors that have direct or indirect effects on aquatic ecosystems. However, in the aquatic environment, wood products can be viewed as particulate organic matter and are expected to become part of the aquatic carbon cycle (DoEE, 2017a).

B. Aquatic Toxicity

No data are available.

C. Terrestrial Toxicity

No data are available.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (InChEMS, 2022; ECHA, 2023).

Walnut hulls, nut hulls, almond hulls, vegetable fibre wood fibre and fruit hulls are expected to biodegrade.

They do not meet the screening criteria for bioaccumulation.

Walnut hulls, nut hulls, almond hulls, vegetable fibre, wood fibre and fruit hulls are not expected to exhibit aquatic toxicity.

Walnut hulls, nut hulls, almond hulls, vegetable fibre, wood fibre and fruit hulls are not PBT substances.

B. Other Characteristics of Concern

No other characteristics of concern were identified for walnut hulls, nut hulls, almond hulls and fruit hulls.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment [1]	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required[3]
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity [2]	Chronic Toxicity[2]	
Walnut hulls, nut hulls, almond hulls, vegetable fibre, wood fibre and fruit hulls	NA	Not a PBT	No	No	No	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 – Tier 1 – Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

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B. Abbreviations and Acronyms

AICS	Australian Inventory of Chemical Substances
COC	constituent of concern
DoEE	Department of the Environment and Energy
ECHA	European Chemicals Agency
EU	European Union
IChEMS	Industrial Chemicals Environmental Management Standard
IUPAC	International Union of Pure and Applied Chemistry
PBT	Persistent, Bioaccumulative and Toxic

REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases

ZINC OXIDE

This dossier on zinc oxide presents the most critical studies pertinent to the risk assessment of the substance in its use in coal seam or shale gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

NICNAS has assessed zinc oxide in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to human health.[1]

I. SUBSTANCE IDENTIFICATION

Chemical Name (IUPAC): Oxozinc

CAS RN: 1314-13-2

Molecular formula: ZnO

Molecular weight: 81.4 g/mol

Synonyms: Zinc oxide; oxozinc

SMILES: O=[Zn]

II. PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1: Overview of the Physico-chemical Properties of Zinc Oxide

Property	Value	Klimisch Score	Reference
Physical state at 20°C and 101.3 kPa	White odorless powder	1	ECHA
Melting Point	1,975°C @ 101.3 kPa	1	ECHA
Boiling Point	Substance decomposes before boiling	-	ECHA
Density	5,680 kg/m^3@ 20°C	2	ECHA
Vapour Pressure	0 Pa @ 20°C	-	ECHA
Partition Coefficient (log K_{ow})	Not relevant, substance is inorganic	-	ECHA
Water Solubility	0.0029 g/L @ 20°C	1	ECHA
Flash Point	Not relevant, substance is inorganic	-	ECHA
Auto flammability	Not relevant, substance is not reactive	-	ECHA

[1] https://services.industrialchemicals.gov.au/assessment-detail/?id=6b49433e-f36b-1410-8924-008e64e216c7

Property	Value	Klimisch Score	Reference
Viscosity	Not relevant, substance is a solid	-	ECHA
Henry's Law Constant	Not relevant, substance is inorganic	-	ECHA

III. ENVIRONMENTAL FATE PROPERTIES

Zinc oxide is an insoluble inorganic metal compound that can slowly dissolute to release the zinc metal. The rate of dissolution is dependent on the size of the particle (the smaller the particle, the fast the rate of dissolution) (EU, 2004). Zinc is a naturally occurring element found in the earth's crust and is present in most natural waters in low concentrations (AICIS, 2024).

Zinc is an essential element which is actively regulated by organisms, therefore bioconcentration/bioaccumulation is not considered relevant for all inorganic zinc substances (ECHA).

The following excerpt was obtained from AICIS' Evaluation Statement on the Environmental Fate and Effects of Zinc Ions (AICIS, 2024).

> *"...The behaviour of the zinc(2+) ion depends on the chemistry of the environmental compartment into which it is released. Dissolved zinc will exist in natural waters as the free (hydrated) zinc(2+) ion, inorganic compounds and complexes, and complexes with dissolved organic matter (DOM), depending on the pH, water hardness, salinity and presence of DOM. Most of this zinc will partition to sediments via adsorption and precipitation but may be dissolved or desorbed due to decreasing pH, increasing salinity or oxidising conditions. Zinc in soils is expected to be strongly sorbed to particulates, and therefore have low mobility, but may be released due to decreasing pH or oxygen concentrations...*
>
> *...Most dissolved zinc in natural waters will partition to sediments. Zinc in aquatic environments is adsorbed onto iron and manganese oxides, clay minerals, or organic materials (Eisler 1993). Dissolved zinc also precipitates as zinc hydroxide, sulfide, carbonate, insoluble organic complexes and with iron and manganese oxyhydroxides (ATSDR 2005; Eisler 1993). The extent of zinc sorption depends on pH and salinity. Zinc will sorb more readily at pH > 7 and low salinity. Inorganic zinc compounds also precipitate more readily at higher pH (ATSDR 2005). Zinc species may be dissolved or desorbed from sediments as pH decreases or salinity increases (ATSDR 2005) and under anoxic conditions (DCCEEW 2021a). Zinc may also be remobilised when sediments are oxidised due to disturbance by organisms or during flooding events (Zoumis et al. 2001).*
>
> *In soils, zinc sorbs to organic matter, oxyhydroxides and sometimes to clay minerals (Huang et al. 1977; Mertens and Smolders 2013). Dissolved zinc may also precipitate as a sulfide, carbonate, (hydr)oxides or calcium zincate, depending on the chemical species present in soil (ATSDR 2005). Zinc solubility, and therefore mobility, is largely controlled by sorption processes. Zinc sorbs strongly to soil particulates but is desorbed as pH decreases (ATSDR 2005; Mertens and Smolders 2013; Stephan et al. 2008). Zinc may also be released from (hydr)oxide phases via reductive dissolution when oxygen concentrations decrease, such as during flooding events. However, under persistent low-oxygen conditions, the precipitation of poorly soluble zinc sulfide may limit zinc mobility (ATSDR 2005). In the soil solution, zinc is present as the free zinc(2+) ion and Zn-DOM complexes. (Stephan et al. 2008). However, formation of Zn-DOM*

complexes does not seem to prevent sorption of zinc to the solid phase, and overall zinc mobility in soils is expected to be low (Ashworth and Alloway 2004; ATSDR 2005).”

IV. HUMAN HEALTH HAZARD ASSESSMENT

A. Summary

The bioavailability of zinc oxide from the gastrointestinal tract is approximately 12-18%. Zinc oxide has low acute toxicity by the oral, dermal, and inhalation routes. It is non-irritating to the skin and eyes, and it is not a skin sensitiser. Rats and mice given repeated oral doses of zinc monoglycerolate or zinc sulphate show copper deficiency and pathological changes in the pancreas. It is not genotoxic or carcinogenic and is not a reproductive or developmental toxicant.

B. Metabolism

People with adequate nutritional levels absorb 20-30% zinc and animals 40-50% zinc. People that are zinc-deficient absorb more, and people that ingest excessive zinc absorb less. For zinc oxide, the bioavailability has been shown to be about 60% of that for soluble zinc salts, corresponding to 12-18% (OECD, 2005).

C. Acute Toxicity

The oral LD50 value in rats for zinc oxide is >5,000 mg/kg (ECHA) [Kl. score = 2].

The 4-hour inhalation LC50 value in rats for zinc oxide is >5.7 mg/L. The mass median aerodynamic diameter was 4mm (ECHA) [Kl. score = 2].

The dermal LD50 in rats of zinc oxide nanoparticles is >2,000 mg/kg (ECHA) [Kl. score = 1].

D. Irritation

Application of 0.5 mL of a 20% zinc oxide suspension in 0.1% Tweens 80 to the skin of rabbits in an open patch for five days was non-irritating (ECHA) [Kl. score = 2].

Instillation of 0.1 mL (64 mg zinc oxide) to the eyes of rabbits was non-irritating (ECHA) [Kl. score = 1].

E. Sensitisation

Zinc oxide was not considered to be a skin sensitiser in a guinea pig maximisation test (ECHA) [Kl. score = 1].

F. Repeated Dose Toxicity

Oral

Male and female SD rats were fed in their diet 0, 0.05, or 0.2% zinc monoglycerolate for 90 days. The average daily intakes are 0, 31.52, and 127.52 mg/kg-day for males; and 0, 35.78, and 145.91 mg/kg-day for females. At 0.2%, there were increases in plasma ALAT, alkaline phosphatase, and creatinine kinase in males; and an increase in plasma creatine kinase in females. The changes were statistically significant but small in absolute terms. Abdominal fat was reduced in a dose-related fashion in the >0.05% males. There was enlargement of the mesenteric lymph nodes in 6/20 of the 0.2% animals

and 1/10 0.05% males. Histopathologic examination showed a reduction in the number of trabeculae in the metaphysis of the tibia of 5 males and 3 females in the 0.2% group, 4 males and 1 female have a similar reduction in the metaphysis of the femur. Pancreatic cell necrosis was seen in both sexes at 0.2% and a slight, but not statistically significant, increase was noted in the 0.05% group. This pancreatic cell necrosis was seen in one control animal. A reduction in the number of pigmentated macrophages in the red pulp of the spleen was observed in the 0.2% animals and a marginal reduction was also seen in the 0.05% males. There were no histopathological effects seen in the reproductive organs of the treated animals in either dose group. The no observed adverse effect level (NOAEL) for this study is 0.05% zinc sulphate in the diet, which corresponds to 32 or 36 mg zinc monoglycerolate/kg-day for males and females, respectively. The NOAEL of 32 mg zinc monoglycerolate/kg-day is equivalent to approximately 13 mg Zn/kg-day (ECHA) [Kl. score = 2].

Male and female Wistar rats were fed in their diet 0, 300, 3,000 or 30,000 ppm zinc sulphate for 90 days. Animals in the high-dose group showed reduced body weight gain, accompanied by lower feed intake, abnormal values in a few haematological parameters and regressive changes of the pancreatic exocrine gland. Animals in the high-dose group also showed symptoms of discarding the diet from the feed jar by picking it out with their fore-limbs. This symptom began a week after the study started and persisted throughout the exposure period. The NOAEL for this study is 3,000 ppm, which corresponds to 234 and 243 mg/kg-day for male and female rats, respectively. The NOAEL of 234 mg zinc sulphate/kg-day is equivalent to approximately 53.5 mg Zn/kg-day (ECHA) [Kl. score = 2].

Male and female ICR mice were fed in their diet 0, 300, 3,000 or 30,000 ppm zinc sulphate for 90 days. Animals in the high-dose group showed reduced body weight gain and water intake, and significant deviations in biochemical parameters. Histopathological examination showed catarrh at the upper intestine, ulcers at the boundary of the fore- and glandular stomach, proliferation of erythropoietic immature cells in the splenic red pulp as well as pancreatic lesions. The NOAEL for this study is 3,000 ppm, which corresponds to 458 and 479 mg zinc sulphate/kg-day for males and females, respectively. The NOAEL of 458 mg zinc sulphate/kg-day is equivalent to approximately 104 mg Zn/kg-day (ECHA) [Kl. score = 2].

Inhalation

No adequate studies are available.

Dermal

No adequate studies are available.

G. Genotoxicity

Based on the weight of the evidence from in vitro and in vivo genotoxicity assays, it is concluded that coated and uncoated nano-size zinc oxide does not have biologically relevant genotoxic activity (ECHA).

In Vitro Studies

The *in vitro* genotoxicity studies on zinc oxide are presented in Table 2.

Table 2: *In vitro* Genotoxicity Studies on Zinc Oxide

Test System	Results*		Klimisch Score	Reference
	-S9	+S9		
OECD Guideline 471 (Bacterial Reverse Mutation Assay) S. typhimurium TA 1535, TA 1537, TA 98, TA 100 and E. coli WP2	-	-	1	ECHA
OECD Guideline 473 (In Vitro Mammalian Chromosome Aberration Test)	-	-	1	ECHA
OECD Guideline 476 (In Vitro Mammalian Cell Gene Mutation Test) mouse lymphoma L5178Y cells	-	-	1	ECHA
in vitro gene mutation study in bacteria	-	-	2	ECHA
in vitro mammalian chromosome aberration test	-	-	2	ECHA

*+, positive; -, negative

In Vivo Studies

In an OECD Guideline 489 (In vivo Mammalian Alkaline Comet Assay), two nanosized test substances Zinc oxide T0420 and Zinc oxide T0421 were assessed for their genotoxic potential after a 14-day exposure period via inhalation.

Wistar rats were exposed whole-body to the indicated concentrations of each test substance (0.5, 2.0 and 8.0 mg/m³) for a 6 h period per day for 14 days. In addition, for comparison, a micro-scaled Zinc oxide as well as well as a soluble Zinc salt (Zinc sulphate monohydrate) were tested in parallel under the same conditions at a single (equimolar) concentration. Ethylmethane sulfonate (EMS) was used as a positive control and applied orally at a single time point.

During the exposure period, the animals were observed for signs of toxicity before, during and after the exposure. Body weight was determined once weekly. In animals exposed to test item 1, concentration-related increases of lavage parameters were observed, as well as in animals exposed to test item 2. The exposure of single concentration of reference substance 1 and 2 caused significantly increases in most of the lavage parameters. The changes in lavage fluid demonstrate the toxicity in the lungs, which were comparable with the range finding study.

The target tissues addressed in this study were the nasal epithelium, the lung, the liver as well as the bone marrow. The assessment of the target tissues in the comet assay did not show any biologically relevant increases in the % tail intensity of the analysed tissues under the indicated conditions. The positive control group showed a distinct and statistically significant increase in all analysed tissues. Thus, under the indicated circumstances, the two test substances as well as the reference substances (micro-scaled Zinc oxide and Zinc sulphate monohydrate) are considered as non-genotoxic in this assay (ECHA). [Kl. Score=1]

In an *in vivo* mammalian somatic cell study: cytogenicity / erythrocyte micronucleus, five rats per sex and group were exposed at a concentration level of 7.93 mg/m³ with Z-COTE HP1 for 14 days. Fresh air treated animals served as concurrent control. Positive control animals were orally exposed to 20 mg/kg cyclophosphamide monohydrate.

There was no treatment-related reduction of body weights in any test group; no clinical signs were detected. However, high dose rats showed adverse local effects in the lungs. In male rats, the test item and the reference substances did not mediate significant repression of red blood cell formation. In females, the PCE/NCE was significantly reduced in the positive control as well as in females exposed to 8 mg/m³ uncoated Z-COTE. This effect might indicate that these test items reached the bone marrow as target organ. However, toxicokinetic data obtained in parallel showed the test material to be not available in the blood stream. There was no evidence of a significantly enhanced mean frequency of micronucleated erythrocytes due to Z-COTE HP1 exposure in males or females, as compared to the vehicle control groups (clean air) at any dose level. The positive and vehicle controls gave valid results. Therefore, it was concluded that inhaled Z-COTE is considered non-mutagenic in immature bone marrow erythrocytes (PCE) of Wistar rats under the conditions tested (ECHA). [Kl. Score=1]

H. Carcinogenicity

In a one-year drinking water study conducted on Chester Beatty stock mice, doses of zinc sulphate [22 g/L (5,000 ppm zinc) and 4.4 g/L (1,000 ppm zinc)] in drinking water along with a control group fed a basal diet and normal drinking water. The animals were examined thoroughly once a wk throughout the experiment and daily when fed. Weighing was done once every 2 wk. Deaths of animals occurred during the first 8 wk of experiment due to an epizootic of ectromelia. The survivors were vaccinated with sheep lymph and animals showing a negative or accelerated response were sacrificed. New group of weanling mice (4 -5 wk old) were added to supplement the control group. All the surviving animals were sacrificed after 1 year of treatment and examined for gross pathology. Histopathological examination was done for suspected neoplastic lesions. Stomachs were examined for tumours and other changes in the forestomach and glandular epithelium. No differences in carcinogenic effects were observed between treatment and control groups under the test conditions. Under the test conditions, the test material was found to be non-carcinogenic in mice (ECHA). [Kl. Score = 2]

There are a range of epidemiological studies that investigated the association between zinc exposure either through occupational activities or food supplementation and increased cancer risks. While no associations were found between occupational zinc exposure and excess cancer risk, the main association that has been made in this context is related to dietary/supplemental zinc and prostate cancer risk (ECHA).

I. Reproductive Toxicity

A two-generation reproductive toxicity study has been conducted on zinc chloride. Male and female SD rats were given oral gavage doses of 0, 7.5, 15, or 30 mg/kg. In the 30 mg/kg F0 and F1 parental animals, there was significant reduction in fertility, viability (days 0 and 4), and the body weight of 30 mg/kg F1 and F2 pups were significantly reduced but caused no effects on litter size, weaning index, and sex ratio. Significant reduction in body weights of F0 and F1 parental males and postpartum dam weights female rats. In the F0 and F1 rats, brain, liver, kidney, spleen and seminal vesicles weights of males were reduced, as well as the spleen and uterus of females. Gross lesions were observed in gastrointestinal tract, lymphoreticular/ hematopoietic and reproductive tract in parental rats in both generations. Reduced body fat was also recorded in F1 parental rats. The NOAEL for reproductive and developmental toxicity for this study was considered to be 15 mg zinc chloride/kg-day or 7.2 mg Zn/kg-day. The LOAEL for parental toxicity is 7.5 mg/kg-day or 3.6 mg Zn/kg-day (Khan et al., 2007; ECHA) [Kl. score = 2].

J. Developmental Toxicity

Oral

Pregnant female Wistar rats were dosed by oral gavage with 0, 0.4, 2, 9.1, or 42.5 mg/kg zinc sulphate on GD 6 to 15. There was no maternal or developmental toxicity. The NOAEL for maternal and developmental toxicity is 42.5 mg zinc sulphate/kg-day or 9.6 mg Zn/kg-day (ECHA) [Kl. score = 2]

Pregnant female CD-1 mice were dosed by oral gavage with 0, 0.3, 1.4, 6.5, or 30 mg/kg zinc sulphate on GD 6 to 15. There was no maternal or developmental toxicity. The NOAEL for maternal and developmental toxicity is 42.5 mg zinc sulphate/kg-day or 9.6 mg Zn/kg-day (ECHA) [Kl. score = 2

Pregnant female Dutch rabbits were dosed by oral gavage with 0, 2, 8, 13, or 60 mg/kg zinc sulphate on GD 6 to 15. There was no maternal or developmental toxicity. The NOAEL for maternal and developmental toxicity is 0 mg zinc sulphate/kg-day or 6.8 mg Zn/kg-day (ECHA) [Kl. score = 2

Inhalation

No studies are available.

Dermal

No studies are available.

V. DERIVATION OF TOXICOLOGICAL REFERENCE AND DRINKING WATER GUIDANCE VALUES

The toxicological reference values developed for cupric nitrate follow the methodology discussed in enHealth (2012). The approach used to develop drinking water guidance values is described in the Australian Drinking Water Guidelines (ADWG, 2021).

Non-Cancer

An oral toxicological reference value was not derived for zinc oxide. The Australian drinking water guidance value of 3 mg/L (aesthetics) for zinc is applicable (ADWG, 2011).

Cancer

Zinc oxide is not considered a carcinogen. Thus, a cancer reference value was not derived.

VI. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES

Zinc oxide does not exhibit the following physico-chemical properties:

- Explosivity
- Flammability
- Oxidising potential

VII. ENVIRONMENTAL HAZARD ASSESSMENT

A. Summary

Zinc oxide is expected to have low acute and chronic toxicity to aquatic organisms. Studies on the terrestrial toxicity of zinc oxide are not available.

B. Aquatic Toxicity

It is generally considered that Zn^{2+} is the form of zinc primarily responsible for eliciting a toxic response in aquatic organisms. Typically, inorganic and organic complexes ameliorate the uptake and toxicity of zinc by reducing the concentration of Zn^{2+}. An exponential, inverse relationship has been shown to exist between water hardness and the uptake and toxicity of zinc. Acute and chronic aquatic toxicity data compiled by ANZG (ANZG, 2021) is provided within this section and is consistent with the data reported in ECHA.

Acute Studies

USEPA (1987) compiled acute toxicity values of zinc for 43 freshwater species. At a hardness of 50 mg/L, the concentrations ranged from 51 µg/L to 81,000 µg/L. Bacher and O'Brien (1990) found the acute toxicities for Australian freshwater species ranged from 140 µg/L to 6900 µg/L, and Skidmore and Firth (1983) found a range of 340 to 9600 µg/L for ten Australian species. Zinc was found to bioaccumulate in freshwater animal tissues 50 to 1130 times but bioaccumulation is not generally considered a problem for zinc (ANZG, 2021).

Chronic Studies

The ANZG water quality guideline (2021) derived very high reliability default guideline values (DGVs) for zinc in freshwater from 85 data points covering 6 taxonomic groups, and these were adjusted to a common hardness of 30 mg/L as $CaCO_3$ and other endpoints adjusted to NOECs as follows (pH range was 6.75 to 8.39):

- Fish: 11 species, 24 µg/L (*Oncorhynchus tshawytscha*; from LC50) to 1316 µg/L (*Ptylocheilus oregonensis*; from LC50); seven species had geometric means < 250 µg/L and a measured NOEC of 38 µg/L was reported for *Pimephales promelas*.
- Amphibians: one species, *Ambystoma opacum*, 180 µg/L (from LOEC).
- Crustaceans: three species, 5.5 µg/L (*C. dubia;* from LC50) to 25.3 µg/L (*C. dubia*), plus a figure of 18,480 for the crayfish *Orconectes virillis*).
- Insect: one species, *Tanytarsus dissimilis*, 5 µg/L (NOEC).
- Molluscs: three species, 54 µg/L (*Dreissena polymorpha*) to 11,200 µg/L (*Velesunio ambigua*), a NOEC of 487 µg/L was measured for *Physa gyrina*.
- Annelid: one species, *Limnodrilus hoffmeisteri*, 560 µg/L (from LC50).

The available evidence, notably on the chronic data, shows that for all environmental compartments, the ecotoxicity zinc oxide is similar or lower than the toxicity of the zinc ion. This is generally explained by the rapid dissolution of zinc oxide in environmental media (ECHA).

C. Terrestrial Toxicity

Similar to aquatic toxicity, the soluble zinc ion (Zn^{2+}) is considered as the toxic entity for zinc substances in soil. Reliable chronic toxicity data are available for the long-term effect of zinc on 35 terrestrial species or microbial endpoints covering the 3 trophic levels (12 terrestrial plants, 10

invertebrates and 13 microbial endpoints). A total of 220 reliable EC10 and NOEC values, ranging between 31.2 and 8003.5 mg Zn/kg dry weight (dw). All results were derived for soluble zinc substances ($Zn(CH_3COO)_2$, $ZnCl_2$, $Zn(NO_3)_2$ or $ZnSO_4$, including hydrated forms).

The bioavailability and toxicity of zinc to soil organisms was significantly affected by the equilibration time and the properties of the soils tested. Toxicity to soil organisms decreased with longer equilibration time, showing lower toxicity in field conditions compared to standard laboratory settings. Toxicity to terrestrial plants decreased with higher effective cation exchange capacity (eCEC = CEC at pH of the soil) and higher pH of the soil. Toxicity to terrestrial invertebrates decreased with higher eCEC and toxicity to microbial endpoints decreased with higher background Zn concentrations in soil.

There are comparable data on the effect of zinc oxide (compared to zinc ion toxicity) available for soil invertebrates (4 species), plants (10 species) and soil microorganisms. From these data, it follows that the toxicity of the zinc oxide form is in general lower than the toxicity of the zinc ion (ECHA).

D. Calculation of PNEC

The PNEC calculations for zinc oxide follow the methodology discussed in DEWHA (2009).

PNEC Water

The ANZG water quality guideline (2021) derived a very high reliability DGV for zinc in freshwater. The DGVs for 99, 95, 90 and 80% species protection are 2.4 µg/L, 8 µg/L, 15 µg/L and 31 µg/L, respectively. The 95% species protection level for zinc in freshwater (8 µg/L) is recommended for adoption in the assessment of slightly-to-moderately disturbed ecosystems. It applies to waters of hardness of 30 mg/L as $CaCO_3$ (ANZG, 2021).

PNEC Sediment

The ANZG sediment quality guideline (2019) derived DGVs for zinc in sediment based on the effects range low (ERL) and effects range median (ERM) values of Long et al. (1995). The DGV of 200 mg/kg represents the ERL while the GV-high of 410 mg/kg represents the ERM. Sediment DGVs are applicable to the <2mm sediment fraction of a sediment sample.

PNEC Soil

In place of a PNEC for the soil compartment, the ecological investigation level (EIL) for zinc from the ASC NEPM has been used. In soils, the added contaminant limit for fresh contamination (contaminant present for < 2 years) is 20–330 mg added Zn/kg and 70–1,300 mg added Zn/kg for aged contamination (contaminant present > 2 years) (ASC NEPM, 2013).

VIII. PERSISTENCE, BIOACCUMULATION AND TOXICITY (PBT) ASSESSMENT

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU Reach Criteria methodology (IChEMS, 2022; ECHA, 2023). Note that PBT assessments are not relevant for metals (ECHA). Despite this, efforts were made to consider PBT for zinc oxide.

Zinc oxide is an inorganic metal substance that can slowly dissolute to release the zinc metal. Biodegradation is not applicable to this substance.

Zinc is an essential metal that is found naturally in the environment. All living organisms have homeostasis mechanisms that actively regulate zinc uptake and absorption/excretion; due to this regulation, zinc and zinc compounds do not bioaccumulate or biomagnify.

Zinc oxide is relatively insoluble which limits its bioavailability. However, there is a measurable rate of dissolution of zinc metal from zinc oxide. Zinc metal is highly toxicity to aquatic organisms. Thus, zinc oxide meets the criteria for toxicity.

The overall conclusion is that zinc oxide is not a PBT substance.

IX. CLASSIFICATION AND LABELLING

A. Classification

Aquatic Acute Toxicity Category 1

B. Aquatic Chronic Toxicity Category 2Labelling

Warning

C. Pictogram



X. HANDLING AND SAFETY INFORMATION (OCCUPATIONAL LIMITS AND TRANSPORTATION REQUIREMENTS)

A. First Aid

Please refer to the product SDS for additional information and confirmation of the information provided herein.

Eye Contact

Separate eyelids, wash the eyes thoroughly with water (15 min.). Seek eye treatment by an oculist.

Skin Contact

Wash thoroughly with soap and water.

Inhalation

Ensure supply of fresh air. Take medical treatment.

Ingestion

Rinse out mouth and give plenty of water to drink. Administer activated charcoal.

B. Fire Fighting Information

Extinguishing Media

Product itself is non-combustible; adapt fire extinguishing measures to surrounding areas.

Specific Exposure Hazards

None.

Special Protective Equipment for Firefighters

Wear self-contained breathing apparatus.

C. Accidental Release Measures

Personal Precautions

Use appropriate protective equipment. Handle in accordance with good industrial hygiene and safety practice. Avoid dust formation.

Environmental Precautions

Prevent from entering sewers, waterways or low areas.

Steps to be Taken if Material is Released or Spilled

Pick up mechanically. Avoid raising dust. Send in suitable containers for recovery or disposal.

D. Storage And Handling

General Handling

Provide good ventilation of working area (local exhaust ventilation, if necessary). Keep away from sources of ignition - refrain from smoking. Take precautionary measures against static charges.

Storage

Keep container tightly closed and in a dry and well-ventilated place. Keep in a cool place. Do not store together with foodstuffs. Do not store together with animal feedstocks. Do not store together with acids or bases.

E. Exposure Controls / Personal Protection

Occupational Exposure Standards

The workplace exposure standards for zinc oxide (dust) in Australia is as follows: 10mg/m^3 as an 8-hour TWA.

Engineering Controls

Good general ventilation should be used.

Personal Protection Equipment

Respiratory Protection: If workplace exposure limits are exceeded, a respiration protection approved for this particular job must be worn..

Hand Protection: Protective gloves (EN 374).

Skin Protection: Clothing as usual in the chemical industry.

Eye protection: Safety glasses (EN 166).

Other Precautions:

Do not eat, drink or smoke during work time. After worktime and during work intervals the affected skin areas must be thoroughly cleaned. Store work clothing separately. Do not inhale dust..

F. Transport Information

UN 3077. ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Zinc oxide)

Class 9

Packing Group III

Label: GHS09

XI. DISPOSAL MANAGMENT

Disposal should be in accordance with all local, state and federal regulations.

XII. REGULATORY STATUS

Australian AICS Inventory: Listed.

XIII. REFERENCES

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Attachment B Safety Data Sheets

HALLIBURTON

SAFETY DATA SHEET

BridgeMaker II LCM

Revision date: 30-Mar-2026 **Revision Number:** 21

Section 1: Identification: Product identifier and chemical identity

Product identifier

Product Name BridgeMaker II LCM

Product Code(s) HM008048

Other means of identification

Pure substance/mixture Mixture

Recommended use of the chemical and restrictions on use

Recommended use Lost Circulation Material
Uses advised against No information available.

Details of manufacturer or importer

Halliburton Australia Pty. Ltd.
15 Marriott Road, Jandakot, WA 6164
Australia
ACN Number: 009 000 775
Telephone Number: + 61 (08) 6424 4800

For further information, please contact

fdunexchem@halliburton.com

Emergency telephone number

Australia Emergency Telephone Number + 61 1 800 686 951
Global Incident Response Access Code: 334305
Contract Number: 14012

Australian Poisons Information Centre 24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

Section 2: Hazard(s) identification

Statement of Hazardous Nature: Non-Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

GHS Classification

Not a hazardous substance or mixture according to the Globally Harmonised System (GHS). Not classified.

Label elements

Hazard statements

Not a hazardous substance or mixture according to the Globally Harmonised System (GHS). Not classified.

Other hazards which do not result in classification

No information available.

Section 3: Composition/information on ingredients

The product contains no substances which at their given concentration, are considered to be hazardous to health

Chemical name	CAS No.	Weight-%
Non-hazardous ingredients	Proprietary	Balance

Section 4: First aid measures

Description of first aid measures

Inhalation Remove to fresh air.

Eye contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a doctor.

Skin contact Wash skin with soap and water.

Ingestion Rinse mouth.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Effects of Exposure No information available.

Indication of any immediate medical attention and special treatment needed

Note to doctors Treat symptomatically.

Section 5: Firefighting measures

Suitable Extinguishing Media

Suitable extinguishing media Water fog, carbon dioxide, foam, dry chemical.

Large Fire CAUTION: Use of water spray when fighting fire may be inefficient.

Unsuitable extinguishing media Do not scatter spilled material with high pressure water streams.

Specific hazards arising from the chemical

Specific hazards arising from the chemical No information available.

Carbon monoxide and carbon dioxide.

Special protective actions for fire-fighters

Special protective equipment and precautions for fire-fighters Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protective equipment.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions	Ensure adequate ventilation.
For emergency responders	Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions	See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so.

Precautions to prevent secondary hazards

Prevention of secondary hazards	Clean contaminated objects and areas thoroughly observing environmental regulations.

Section 7: Handling and storage, including how the chemical may be safely used

Precautions for safe handling

Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice.
General hygiene considerations	If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

Conditions for safe storage, including any incompatibilities

Storage Conditions	Store away from oxidizers. Store in a dry location. Keep from heat, sparks, and open flames. Store away from alkalis. Product has a shelf life of 60 months.
Incompatible materials	Strong acids. Strong alkalis.

Section 8: Exposure controls and personal protection

Control Parameters

Exposure Limits	This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.
Biological occupational exposure limits	This product, as supplied, does not contain any hazardous materials with biological limits established by the region specific regulatory bodies

Appropriate engineering controls

Engineering controls	A well ventilated area to control dust levels.

Individual protection measures, such as personal protective equipment

Eye/face protection	Wear safety glasses or goggles to protect against exposure. (EN-166).
Skin and body protection	Normal work coveralls.

Hand protection	Normal work gloves.
Respiratory protection	Not normally needed. But if significant exposures are possible then the following respirator is recommended: Dust/mist respirator. (N95, P2/P3).
Environmental exposure controls	No information available.
Other protective equipment	Eyewash fountains and safety showers must be easily accessible.
Thermal hazards	No information available.

Section 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state	Solid
Appearance	No information available
Colour	Variable Beige Black White Grey
Odour	Odourless.
Odour threshold	No information available

Property	**Values**	**Remarks • Method**
pH	No data available	
Melting point / freezing point	No data available	
Initial boiling point and boiling range	4200 °C / 7592 °F	
Flash point	No data available	
Evaporation rate	No data available	
Flammability	No data available	
Flammability Limit in Air		
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapour pressure	No data available	
Relative vapour density	No data available	
Relative density	1.85	
Water solubility	Insoluble in water	
Solubility(ies)	No data available	
Partition coefficient	No data available	
Autoignition temperature	No data available	
Decomposition temperature		
Kinematic viscosity	No data available	
Dynamic viscosity	No data available	
Other information		
Pour Point	No data available	
VOC content	No information available	
Particle characteristics	No information available	

Section 10: Stability and reactivity

Reactivity

Reactivity	No information available.

Chemical stability

Stability	Stable under normal conditions.

Explosion data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid None known based on information supplied.

Incompatible materials

Incompatible materials Strong acids. Strong alkalis.

Hazardous decomposition products

Hazardous decomposition products Carbon monoxide and carbon dioxide.

Section 11: Toxicological information

Information on likely routes of exposure

Principle Routes of Exposure Ingestion, Skin contact, Eye contact, Inhalation

Product Information

Inhalation Specific test data for the substance or mixture is not available.

Eye contact Specific test data for the substance or mixture is not available.

Skin contact Specific test data for the substance or mixture is not available.

Ingestion Specific test data for the substance or mixture is not available.

Symptoms No information available.

Acute toxicity .

Numerical measures of toxicity - Product Information
No information available

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	99,999.00	mg/kg
ATEmix (dermal)	99,999.00	mg/kg
ATEmix (inhalation-gas)	99,999.00	ppm
ATEmix (inhalation-vapour)	99,999.00	mg/L
ATEmix (inhalation-dust/mist)	99,999.00	mg/L

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation Based on available data, the classification criteria are not met.

Serious eye damage/eye irritation Based on available data, the classification criteria are not met.

Respiratory or skin sensitisation Based on available data, the classification criteria are not met.

Germ cell mutagenicity	Based on available data, the classification criteria are not met.
Carcinogenicity	Based on available data, the classification criteria are not met.
Reproductive toxicity	Based on available data, the classification criteria are not met.
STOT - single exposure	Based on available data, the classification criteria are not met.
STOT - repeated exposure	Based on available data, the classification criteria are not met.
Aspiration hazard	Based on available data, the classification criteria are not met.

Section 12: Ecological information

Ecotoxicity	Based on available data, the classification criteria are not met
Terrestrial ecotoxicity	There is no data for this product.
Persistence and degradability	Based on available data, the classification criteria are not met
Bioaccumulation	There is no data for this product.
Mobility	Based on available data, the classification criteria are not met
Other adverse effects	No data available

Section 13: Disposal considerations

Disposal methods

Waste from residues/unused products	Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.
Contaminated packaging	Do not reuse empty containers.

See section 8 for more information

Section 14: Transport information

ADG	Not regulated
IATA	Not regulated
IMDG	Not regulated

Transport in bulk according to Annex II of MARPOL and the IBC Code

No information available

Section 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
No poisons schedule number allocated

Australian Industrial Chemicals Introduction Scheme (AICIS)
Contact supplier for inventory compliance status

Illicit Drug Precursors/Reagents
This product does not contain any substance(s) on the Illicit Drug Precursors/Reagents list.

International Inventories

TSCA	All components listed on inventory or are exempt
AIIC	All components listed on inventory or are exempt
NZIoC	All components listed on inventory or are exempt

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
AIIC - Australian Inventory of Industrial Chemicals
NZIoC - New Zealand Inventory of Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Not applicable

Section 16: Any other relevant information

Revision date 30-Mar-2026

Reason for revision Update to Format

Key or legend to abbreviations and acronyms used in the safety data sheet
ADR - The European Agreement concerning the International Carriage of Dangerous Goods by Road
bw – body weight
CAS – Chemical Abstracts Service
CLP – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Classification, Labelling and Packaging of substances and mixtures

EN 149 - European standard on filtering halfmasks to protect against particles
FFP - Filtering Facepieces
h - hour
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LL50 – Lethal Loading 50%
d - day
Derived No Effect Level (DNEL)
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
IATA/ICAO - International Air Transport Association / International Civil Aviation Organization
IMDG/IMO - International Maritime Dangerous Goods / International Maritime Organization
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
REACH – REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
VOC – Volatile Organic Carbon
UN – United Nations
VLA-EC - short-time excursion limits [Spain valores límite ambientales para la exposición de corta duración]
vPvB – very Persistent and very Bioaccumulative
w/w - weight/weight
Water hazard class (WGK)
UN – United Nations
VOC – Volatile Organic Carbon
TWA - Time-Weighted Average
STEL – Short Term Exposure Limit

Legend Section 8: Exposure controls/personal protection

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	Sk*	Skin designation
+	Sensitisers		

Key literature references and sources for data used to compile the SDS

Acute Exposure Guideline Level(s) (AEGL(s))
European Chemicals Agency (ECHA) (ECHA_API)
European Chemicals Agency (ECHA) Committee for Risk Assessment (ECHA_RAC)
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
NIOSH (National Institute for Occupational Safety and Health)

Disclaimer

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information isobtained from various sources including the manufacturer and other third party sources. The information may not be validunder all conditions nor if this material is used in combination with other materials or in any process. Final determination ofsuitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **CALCIUM CHLORIDE LIQUID**

Revision Date: 22-Apr-2019 **Revision Number:** 25

1. Identification

1.1. Product Identifier

Product Trade Name: CALCIUM CHLORIDE LIQUID
Synonyms None
Chemical Family: Inorganic Salt
Internal ID Code HM000143

1.2 Recommended use and restrictions on use

Application: Brine
Uses advised against No information available

1.3 Manufacturer's Name and Contact Details

Manufacturer/Supplier
Halliburton Energy Services, Inc.
P.O. Box 1431
Duncan, Oklahoma 73536-0431
Telephone: 1-281-871-6107

Halliburton Group Canada
645 - 7th Ave SW Suite 1800
Calgary, AB, T2P 4G8, Canada
Telephone: 1-403-231-9300

Prepared By Chemical Stewardship
Telephone: 1-281-871-6107
e-mail: fdunexchem@halliburton.com

1.4. Emergency telephone number:

Emergency Telephone Number 1-866-519-4752 or 1-760-476-3962 (accessible 24 hours a day / 7 days a week)
Global Incident Response Access Code: 334305
Contract Number: 14012

2. Hazards Identification

2.1 Classification in accordance with paragraph (d) of §1910.1200

Serious Eye Damage/Irritation	Category 2 - H319

2.2. Label Elements

Hazard Pictograms



Signal Word: Warning

Hazard Statements H319 - Causes serious eye irritation

Precautionary Statements

Prevention P264 - Wash face, hands and any exposed skin thoroughly after handling
P280 - Wear eye protection/face protection

Response P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P337 + P313 - If eye irritation persists: Get medical advice/attention

Storage None

Disposal None

2.3 Hazards not otherwise classified

None known

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Calcium chloride	10043-52-4	30 - 60%	Eye Irrit. 2A (H319)

The exact percentage (concentration) of the composition has been withheld as proprietary.

4. First Aid Measures

4.1. Description of first aid measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Eyes In case of contact, or suspected contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention immediately after flushing.

Skin Flush skin with large amounts of water. If irritation persists, get medical attention.

Ingestion Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

4.2 Most important symptoms/effects, acute and delayed

Causes eye irritation. Causes mild skin irritation.

4.3. Indication of any immediate medical attention and special treatment needed

Notes to Physician Treat symptomatically.

5. Fire-fighting measures

5.1. Extinguishing media

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons
None known.

5.2 Specific hazards arising from the substance or mixture

Special exposure hazards in a fire
Not applicable

5.3 Special protective equipment and precautions for fire-fighters

Special protective equipment for firefighters
Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Use appropriate protective equipment. Avoid contact with skin, eyes and clothing. Avoid breathing vapors. Ensure adequate ventilation.
See Section 8 for additional information

6.2. Environmental precautions

Prevent from entering sewers, waterways, or low areas.

6.3. Methods and material for containment and cleaning up

Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Scoop up and remove.

7. Handling and storage

7.1. Precautions for safe handling

Handling Precautions
Use appropriate protective equipment. Avoid contact with eyes, skin, or clothing. Avoid breathing vapors. Ensure adequate ventilation. Wash hands after use. Launder contaminated clothing before reuse.
Hygiene Measures
Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities

Storage Information
Store in a cool well ventilated area. Keep container closed when not in use.

8. Exposure Controls/Personal Protection

8.1 Occupational Exposure Limits

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Calcium chloride	10043-52-4	Not applicable	Not applicable

8.2 Appropriate engineering controls

Engineering Controls Use in a well ventilated area.

8.3 Individual protection measures, such as personal protective equipment

Personal Protective Equipment If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

Respiratory Protection If engineering controls and work practices cannot keep exposure below occupational exposure limits or if exposure is unknown, wear a NIOSH certified, European Standard EN 149, AS/NZS 1715:2009, or equivalent respirator when

	using this product. Selection of and instruction on using all personal protective equipment, including respirators, should be performed by an Industrial Hygienist or other qualified professional. Dust/mist respirator. (N95, P2/P3)
Hand Protection	Use gloves which are suitable for the chemicals present in this product as well as other environmental factors in the workplace.
Skin Protection	Wear protective clothing appropriate for the work environment.
Eye Protection	Chemical goggles; also wear a face shield if splashing hazard exists.
Other Precautions	Eyewash fountains and safety showers must be easily accessible.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State:	Liquid	**Color**	Clear
Odor:	Odorless	**Odor Threshold:**	No information available

Property Remarks/ - Method	Values
pH:	5.2
Freezing Point / Range	°C / 39.5 °F
Melting Point / Range	No data available
Pour Point / Range	No data available
Boiling Point / Range	No data available
Flash Point	No data available
Flammability (solid, gas)	No data available
Upper flammability limit	No data available
Lower flammability limit	No data available
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	1.36
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

Molecular Weight	58.44
VOC Content (%)	No data available

10. Stability and Reactivity

10.1. Reactivity

Not expected to be reactive.

10.2. Chemical stability

Stable

10.3. Possibility of hazardous reactions

Will Not Occur

10.4. Conditions to avoid

None anticipated

10.5. Incompatible materials
Amphoteric metals such as aluminum, magnesium, lead, tin, or zinc.

10.6. Hazardous decomposition products
None known.

11. Toxicological Information

11.1 Information on likely routes of exposure
Principle Route of Exposure Eye or skin contact, inhalation.

11.2 Symptoms related to the physical, chemical and toxicological characteristics
Acute Toxicity

Inhalation May cause mild respiratory irritation.
Eye Contact Causes eye irritation.
Skin Contact Causes mild skin irritation.
Ingestion May cause abdominal pain, vomiting, nausea, and diarrhea.

Chronic Effects/Carcinogenicity No data available to indicate product or components present at greater than 0.1% are chronic health hazards.

11.3 Toxicity data

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Calcium chloride	10043-52-4	> 1000 mg/kg (Rat) 2301 mg/kg (Rat) > 2000 mg/kg (Rat) 2240 mg/kg (Rat)	5000 mg/kg (Rabbit)	No data available

Substances	CAS Number	Skin corrosion/irritation
Calcium chloride	10043-52-4	Causes mild skin irritation (Rabbit)

Substances	CAS Number	Serious eye damage/irritation
Calcium chloride	10043-52-4	Causes moderate eye irritation (Rabbit)

Substances	CAS Number	Skin Sensitization
Calcium chloride	10043-52-4	No information available

Substances	CAS Number	Respiratory Sensitization
Calcium chloride	10043-52-4	No information available

Substances	CAS Number	Mutagenic Effects
Calcium chloride	10043-52-4	Did not show mutagenic effects in animal experiments

Substances	CAS Number	Carcinogenic Effects
Calcium chloride	10043-52-4	No information available

Substances	CAS Number	Reproductive toxicity
Calcium chloride	10043-52-4	Animal testing did not show any effects on fertility.

Substances	CAS Number	STOT - single exposure
Calcium chloride	10043-52-4	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Calcium chloride	10043-52-4	No information available.

Substances	CAS Number	Aspiration hazard
Calcium chloride	10043-52-4	Not applicable

12. Ecological Information

12.1. Toxicity

Ecotoxicity effects

Product is not classified as hazardous to the environment.

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Calcium chloride	10043-52-4	ErC50 (72h) 2900 mg/L (Pseudokirchnerella subcapitata) ErC50 (72h) 4000 mg/L (Pseudokirchnerella subcapitata)	LC50 (96h) 4630 mg/L (Pimephales promelas) LC50 (48h) >6560 mg/L (Pimephales promelas) LC50 (24h) >6660 mg/L (Pimephales promelas)	No information available	EC50 (48h) 2400 mg/L (Daphnia magna) EC50 (21d) 610 mg/L (reproduction) (Daphnia magna)

12.2. Persistence and degradability

The methods for determining biodegradability are not applicable to inorganic substances.

Substances	CAS Number	Persistence and Degradability
Calcium chloride	10043-52-4	The methods for determining biodegradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Does not bioaccumulate.

Substances	CAS Number	Bioaccumulation
Calcium chloride	10043-52-4	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Calcium chloride	10043-52-4	No information available

12.5 Other adverse effects

No information available

13. Disposal Considerations

13.1. Waste treatment methods

Disposal methods Follow all applicable community, national or regional regulations regarding waste management methods.

Contaminated Packaging Follow all applicable national or local regulations.

14. Transport Information

US DOT

UN Number Not restricted
UN proper shipping name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

Canadian TDG

UN Number Not restricted

UN proper shipping name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

IMDG/IMO

UN Number Not restricted
UN proper shipping name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

IATA/ICAO

UN Number Not restricted
UN proper shipping name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Not applicable

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable
Special Precautions for User None

15. Regulatory Information

US Regulations

US TSCA Inventory All components listed on inventory or are exempt.

TSCA Significant New Use Rules - S5A2

Substances	CAS Number	TSCA Significant New Use Rules - S5A2	TSCA Section 5(E) Consent Orders
Calcium chloride	10043-52-4	Not applicable	Not applicable

EPA SARA Title III Extremely Hazardous Substances

Substances	CAS Number	EPA SARA Title III Extremely Hazardous Substances
Calcium chloride	10043-52-4	Not applicable

EPA SARA (311,312) Hazard Class
Serious eye damage or eye irritation

EPA SARA (313) Chemicals

Substances	CAS Number	Toxic Release Inventory (TRI) - Group I	Toxic Release Inventory (TRI) - Group II
Calcium chloride	10043-52-4	Not applicable	Not applicable

EPA CERCLA/Superfund Reportable Spill Quantity

Substances	CAS Number	CERCLA RQ
Calcium chloride	10043-52-4	Not applicable

EPA RCRA Hazardous Waste Classification
If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.

California Proposition 65

Substances	CAS Number	California Proposition 65
Calcium chloride	10043-52-4	Not applicable

U.S. State Right-to-Know Regulations

Substances	CAS Number	MA Right-to-Know Law	NJ Right-to-Know Law	PA Right-to-Know Law
Calcium chloride	10043-52-4	Not applicable	Not applicable	Not applicable

NFPA Ratings: Health 1, Flammability 0, Reactivity 0
HMIS Ratings: Health 1, Flammability 0, Reactivity 0

Canadian Regulations

Canadian Domestic Substances List (DSL) All components listed on inventory or are exempt.

16. Other information

Preparation Information

Prepared By Chemical Stewardship
Telephone: 1-281-871-6107
e-mail: fdunexchem@halliburton.com

Revision Date: 22-Apr-2019

Reason for Revision SDS sections updated:
2

Additional information
For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Safety Data Sheet for this or other Halliburton products, contact Chemical Stewardship at 1-580-251-4335.

Key or legend to abbreviations and acronyms used in the safety data sheet
bw – body weight
CAS – Chemical Abstracts Service
d - day
EC50 – Effective Concentration 50%
ErC50 – Effective Concentration growth rate 50%
h - hour
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
NIOSH – National Institute for Occupational Safety and Health
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
STEL – Short Term Exposure Limit
TWA – Time-Weighted Average
UN – United Nations
w/w - weight/weight

Key literature references and sources for data
www.ChemADVISOR.com/

Disclaimer Statement

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

CEMENT - CLASS G + 35% SSA-1

Revision date: 05-Aug-2024 **Revision Number:** 33

Section 1: Identification: Product identifier and chemical identity

Product identifier

Product Name CEMENT - CLASS G + 35% SSA-1

Product Code(s) HM004641

Other means of identification

Synonyms CEMENT CLASS K

Pure substance/mixture Mixture

Recommended use of the chemical and restrictions on use

Recommended use Cement
Uses advised against No information available.

Details of manufacturer or importer

Halliburton Australia Pty. Ltd.
15 Marriott Road, Jandakot, WA 6164
Australia
ACN Number: 009 000 775
Telephone Number: + 61 (08) 6424 4800

For further information, please contact

fdunexchem@halliburton.com

Emergency telephone number

Australia Emergency Telephone Number + 61 1 800 686 951
Global Incident Response Access Code: 334305
Contract Number: 14012

Australian Poisons Information Centre 24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

Section 2: Hazard(s) identification

Statement of Hazardous Nature: Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

GHS Classification

Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 1
Skin sensitisation	Category 1
Carcinogenicity	Category 1A
Specific target organ toxicity — single exposure	Category 3
Specific target organ toxicity — repeated exposure	Category 1

Label elements



Signal word
DANGER

Hazard statements
Causes skin irritation.
Causes serious eye damage.
May cause an allergic skin reaction.
May cause cancer.
May cause respiratory irritation.
Causes damage to organs through prolonged or repeated exposure.

Precautionary Statements - Prevention
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Wash face, hands and any exposed skin thoroughly after handling.
Contaminated work clothing should not be allowed out of the workplace.
Use only outdoors or in a well-ventilated area.
Do not breathe dust/fume/gas/mist/vapours/spray.
Do not eat, drink or smoke when using this product.
Wear protective gloves.
Precautionary Statements - Response
IF exposed or concerned: Get medical advice/attention.
IF ON SKIN: Wash with plenty of water and soap.
Take off all contaminated clothing and wash it before reuse.
If skin irritation or rash occurs: Get medical advice/attention.
IF INHALED: Remove person to fresh air and keep comfortable for breathing.
Call a POISON CENTRE or doctor if you feel unwell.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Immediately call a POISON CENTRE or doctor.
Precautionary Statements - Storage
Store locked up.
Store in a well-ventilated place. Keep container tightly closed.
Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant.

Other hazards which do not result in classification
No information available.

Section 3: Composition/information on ingredients

Chemical name	CAS No.	Weight-%
Portland cement	65997-15-1	60 - 100%
Crystalline silica, quartz	14808-60-7	10 - 30%

If CAS number is "proprietary", the specific chemical identity and percentage of composition has been withheld as a trade secret

Section 4: First aid measures

Description of first aid measures

General advice Immediate medical attention is required. Show this safety data sheet to the doctor in attendance. IF exposed or concerned: Get medical advice/attention.

Inhalation	Remove to fresh air. Get medical attention immediately if symptoms occur. IF exposed or concerned: Get medical advice/attention.
Eye contact	Get immediate medical attention. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Keep eye wide open while rinsing. Do not rub affected area.
Skin contact	Wash off immediately with soap and plenty of water for at least 15 minutes. May cause an allergic skin reaction. In the case of skin irritation or allergic reactions see a doctor.
Ingestion	Rinse mouth. Never give anything by mouth to an unconscious person. Do NOT induce vomiting. Call a doctor.

Most important symptoms and effects, both acute and delayed

Symptoms	Burning sensation. Itching. Rashes. Hives.
Effects of Exposure	May cause cancer. Causes damage to organs through prolonged or repeated exposure.

Indication of any immediate medical attention and special treatment needed

Note to doctors	May cause sensitisation in susceptible persons. Treat symptomatically.

Section 5: Firefighting measures

Suitable Extinguishing Media

Suitable extinguishing media	None - does not burn.
Large Fire	CAUTION: Use of water spray when fighting fire may be inefficient.
Unsuitable extinguishing media	Do not scatter spilled material with high pressure water streams.

Specific hazards arising from the chemical

Specific hazards arising from the chemical	Product is or contains a sensitiser. May cause sensitisation by skin contact. Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

Special protective actions for fire-fighters

Special protective equipment and precautions for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions	Avoid contact with skin, eyes or clothing. Use personal protective equipment as required. Ensure adequate ventilation. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.
Other information	Refer to protective measures listed in Sections 7 and 8.
For emergency responders	Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions Prevent further leakage or spillage if safe to do so.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Precautions to prevent secondary hazards

Prevention of secondary hazards Clean contaminated objects and areas thoroughly observing environmental regulations.

Section 7: Handling and storage, including how the chemical may be safely used

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Do not eat, drink or smoke when using this product. Ensure adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment. Take off contaminated clothing and wash it before reuse. Avoid breathing vapours or mists.

General hygiene considerations Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Do not eat, drink or smoke when using this product. Wash hands before breaks and immediately after handling the product.

Conditions for safe storage, including any incompatibilities

Storage Conditions Store in a cool, dry location. Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Product has a shelf life of 24 months. Keep containers tightly closed in a dry, cool and well-ventilated place. Store locked up. Keep out of the reach of children.

Incompatible materials Hydrofluoric acid. Strong acids. Strong bases. Strong oxidising agents.

Section 8: Exposure controls and personal protection

Control parameters

Exposure Limits

Chemical name	Australia	New Zealand	ACGIH TLV
Portland cement 65997-15-1	TWA: 10 mg/m³	TWA: 3 mg/m³ TWA: 1 mg/m³	TWA: 1 mg/m³ particulate matter containing no asbestos and <1% crystalline silica, respirable particulate matter
Crystalline silica, quartz 14808-60-7	TWA: 0.05 mg/m³	TWA: 0.025 mg/m³	-

Chemical name	OSHA PEL	NIOSH
Portland cement 65997-15-1	TWA: 15 mg/m³ total dust TWA: 5 mg/m³ respirable fraction (vacated) TWA: 10 mg/m³ total dust (vacated) TWA: 5 mg/m³ respirable fraction TWA: 50 mppcf <1% Crystalline silica	IDLH: 5000 mg/m³ TWA: 10 mg/m³ total dust TWA: 5 mg/m³ respirable dust
Crystalline silica, quartz 14808-60-7	TWA: 50 µg/m³ (vacated) TWA: 0.1 mg/m³ respirable dust : (250)/(%SiO2 + 5) mppcf TWA respirable fraction	IDLH: 50 mg/m³ respirable dust TWA: 0.05 mg/m³ respirable dust

	: (10)/(%SiO2 + 2) mg/m³ TWA respirable fraction	

Biological occupational exposure limits This product, as supplied, does not contain any hazardous materials with biological limits established by the region specific regulatory bodies

Appropriate engineering controls

Engineering controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses or goggles to protect against exposure. Dust proof goggles. (EN-166). Tight sealing safety goggles.

Skin and body protection Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing. Wear suitable protective clothing. Long sleeved clothing.

Hand protection Suitable materials for longer, direct contact (recommended: protection index 6, corresponding to > 480 minutes permeation time as per EN 374):. Normal work gloves. Wear suitable gloves. Impervious gloves.

Respiratory protection Wear a NIOSH certified, European Standard EN 149 (FFP2/FFP3), AS/NZS 1715, or equivalent respirator when using this product.

Environmental exposure controls No information available.

Other protective equipment Eyewash fountains and safety showers must be easily accessible.

Thermal hazards No information available.

Section 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state Solid
Appearance No information available
Colour Gray
Odour Odourless.
Odour threshold No information available

Property	Values	Remarks • Method
pH	12.4	None known
Melting point / freezing point	No data available	
Initial boiling point and boiling range		
Flash point	No data available	None known
Evaporation rate	No data available	
Flammability	No data available	
Flammability Limit in Air		
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapour pressure	No data available	
Relative vapour density	No data available	
Relative density	2.97	
Water solubility	Insoluble in water	
Solubility(ies)	No data available	
Partition coefficient	No data available	

Autoignition temperature	No data available
Decomposition temperature	
Kinematic viscosity	No data available
Dynamic viscosity	No data available
Other information	
Pour Point	No data available
VOC content	No information available
Particle characteristics	No information available

Section 10: Stability and reactivity

Reactivity

Reactivity No information available.

Chemical stability

Stability Stable under normal conditions.

Explosion data

Sensitivity to mechanical impact None.
Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid None known based on information supplied.

Incompatible materials

Incompatible materials Hydrofluoric acid. Strong acids. Strong bases. Strong oxidising agents.

Hazardous decomposition products

Hazardous decomposition products Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

Section 11: Toxicological information

Information on likely routes of exposure

Principle Routes of Exposure Ingestion, Skin contact, Eye contact, Inhalation

Product Information

Inhalation Specific test data for the substance or mixture is not available. May cause irritation of respiratory tract.

Eye contact Specific test data for the substance or mixture is not available. Causes serious eye damage. May cause irreversible damage to eyes.

Skin contact Specific test data for the substance or mixture is not available. May cause sensitisation by skin contact. Repeated or prolonged skin contact may cause allergic reactions with susceptible persons. (based on components). Causes skin irritation.

Ingestion Specific test data for the substance or mixture is not available. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.

Symptoms Redness. Burning. May cause blindness. Itching. Rashes. Hives. May cause redness and tearing of the eyes.

Acute toxicity .

Numerical measures of toxicity - Product Information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	99,999.00	mg/kg
ATEmix (dermal)	99,999.00	mg/kg
ATEmix (inhalation-gas)	99,999.00	ppm
ATEmix (inhalation-vapour)	99,999.00	mg/l
ATEmix (inhalation-dust/mist)	99,999.00	mg/l

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Portland cement	> 2000 mg/kg (Rat)	> 2000 mg/kg	> 1 mg/L (Rat) 4h
Crystalline silica, quartz	> 15000 mg/kg (human)	-	-

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation Classification based on data available for ingredients. Causes skin irritation.

Chemical name	**Skin corrosion/irritation**
Portland cement 65997-15-1	Irritating to skin. (Rabbit)
Crystalline silica, quartz 14808-60-7	Non-irritating to the skin

Serious eye damage/eye irritation Classification based on data available for ingredients. Causes burns. Causes serious eye damage.

Chemical name	**Serious eye damage/eye irritation**
Portland cement 65997-15-1	Causes severe irritation and or burns
Crystalline silica, quartz 14808-60-7	Non-irritating to the eye

Respiratory or skin sensitisation May cause an allergic skin reaction.

Chemical name	Respiratory sensitisation
Portland cement 65997-15-1	No information available
Crystalline silica, quartz 14808-60-7	Not classified
Chemical name	**Skin sensitisation**
Portland cement 65997-15-1	May cause sensitisation by skin contact
Crystalline silica, quartz 14808-60-7	Not classified

Germ cell mutagenicity No information available.

Chemical name	**Germ cell mutagenicity**
Portland cement 65997-15-1	No data of sufficient quality are available.
Crystalline silica, quartz 14808-60-7	Not regarded as mutagenic.

Carcinogenicity Contains a known or suspected carcinogen. Classification based on data available for ingredients. May cause cancer.

Chemical name	Carcinogenicity
Portland cement 65997-15-1	No data of sufficient quality are available.
Crystalline silica, quartz 14808-60-7	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure.

The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical name	Australia	European Union	IARC
Crystalline silica, quartz - 14808-60-7	Carc. 1A	-	Group 1

Legend

IARC (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans

Reproductive toxicity No information available.

Chemical name	Reproductive toxicity
Portland cement 65997-15-1	No data of sufficient quality are available.
Crystalline silica, quartz 14808-60-7	This product does not contain any known or suspected reproductive hazards

STOT - single exposure May cause respiratory irritation.

Chemical name	STOT - single exposure
Portland cement 65997-15-1	May cause respiratory irritation.
Crystalline silica, quartz 14808-60-7	No significant toxicity observed in animal studies at concentration requiring classification.

STOT - repeated exposure Causes damage to organs through prolonged or repeated exposure.

Chemical name	STOT - repeated exposure
Portland cement 65997-15-1	No data of sufficient quality are available.
Crystalline silica, quartz 14808-60-7	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)

Aspiration hazard No information available.

Chemical name	Aspiration hazard
Portland cement 65997-15-1	Not applicable
Crystalline silica, quartz 14808-60-7	Based on available data, the classification criteria are not met

Section 12: Ecological information

Ecotoxicity

Aquatic ecotoxicity

Unknown aquatic toxicity 0 % of the mixture consists of component(s) of unknown hazards to the aquatic environment.

Chemical name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Crystalline silica, quartz	EC50(72 h)=440 mg/L (Pseudokirchneriella subcapitata)	LL0(96 h)=10000 mg/L (Danio rerio)	-	LL50(24 h)>10000 mg/L (Daphnia magna)

Terrestrial ecotoxicity There is no data for this product.

Persistence and degradability

Chemical name	Persistence and degradability
Portland cement 65997-15-1	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, quartz 14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.

Bioaccumulation There is no data for this product.

Mobility

Chemical name	Mobility
Portland cement 65997-15-1	No information available
Crystalline silica, quartz 14808-60-7	No information available

Other adverse effects

Section 13: Disposal considerations

Disposal methods

Waste from residues/unused products Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.

Contaminated packaging Do not reuse empty containers.

See section 8 for more information

Section 14: Transport information

ADG Not regulated

IATA Not regulated

IMDG Not regulated

Transport in bulk according to Annex II of MARPOL and the IBC Code
No information available

Section 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
Classified as a scheduled poison according to the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
Poison Schedule Number 4

Australian Industrial Chemicals Introduction Scheme (AICIS)

Chemical name	Australian Industrial Chemicals Introduction Scheme (AICIS)	Additional information	Portland cement - 65997-15-1
Present	-	Crystalline silica, quartz - 14808-60-7	Contact supplier for inventory compliance status
-			

Illicit Drug Precursors/Reagents
This product does not contain any substance(s) on the Illicit Drug Precursors/Reagents list.

International Inventories

TSCA	All components listed on inventory or are exempt
AIIC	All components listed on inventory or are exempt
NZIoC	All components listed on inventory or are exempt

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
AIIC - Australian Inventory of Industrial Chemicals
NZIoC - New Zealand Inventory of Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Not applicable

Section 16: Any other relevant information

Revision date 05-Aug-2024

Reason for revision Update to Format

Key or legend to abbreviations and acronyms used in the safety data sheet
ADR - The European Agreement concerning the International Carriage of Dangerous Goods by Road

bw – body weight
CAS – Chemical Abstracts Service
CLP – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Classification, Labelling and Packaging of substances and mixtures
EN 149 - European standard on filtering halfmasks to protect against particles
FFP - Filtering Facepieces
h - hour
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LL50 – Lethal Loading 50%
d - day
Derived No Effect Level (DNEL)
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
IATA/ICAO - International Air Transport Association / International Civil Aviation Organization
IMDG/IMO - International Maritime Dangerous Goods / International Maritime Organization
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
REACH – REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
VOC – Volatile Organic Carbon
UN – United Nations
VLA-EC - short-time excursion limits [Spain valores límite ambientales para la exposición de corta duración]
vPvB – very Persistent and very Bioaccumulative
w/w - weight/weight
Water hazard class (WGK)
UN – United Nations
VOC – Volatile Organic Carbon
TWA - Time-Weighted Average
STEL – Short Term Exposure Limit

Legend Section 8: Exposure controls/personal protection

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	Sk*	Skin designation
+	Sensitisers		

Key literature references and sources for data used to compile the SDS

Acute Exposure Guideline Level(s) (AEGL(s))
European Chemicals Agency (ECHA) (ECHA_API)
European Chemicals Agency (ECHA) Committee for Risk Assessment (ECHA_RAC)
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
NIOSH (National Institute for Occupational Safety and Health)

Disclaimer

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information isobtained from various sources including the manufacturer and other third party sources. The information may not be validunder all conditions nor if this material is used in combination with other materials or in any process. Final determination ofsuitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

CFR-3L

Revision date: 12-Aug-2025 **Revision Number:** 27

Section 1: Identification: Product identifier and chemical identity

Product identifier

Product Name CFR-3L

Product Code(s) HM000211

Other means of identification

Pure substance/mixture Mixture

Recommended use of the chemical and restrictions on use

Recommended use Friction Reducer
Uses advised against No information available.

Details of manufacturer or importer

Halliburton Australia Pty. Ltd.
15 Marriott Road, Jandakot, WA 6164
Australia
ACN Number: 009 000 775
Telephone Number: + 61 (08) 6424 4800

For further information, please contact

fdunexchem@halliburton.com

Emergency telephone number

Australia Emergency Telephone Number + 61 1 800 686 951
Global Incident Response Access Code: 334305
Contract Number: 14012

Australian Poisons Information Centre 24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

Section 2: Hazard(s) identification

Statement of Hazardous Nature: Non-Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

GHS Classification

Not a hazardous substance or mixture according to the Globally Harmonised System (GHS). Not classified.

Label elements

Hazard statements

Not a hazardous substance or mixture according to the Globally Harmonised System (GHS). Not classified.

Other hazards which do not result in classification

No information available.

Section 3: Composition/information on ingredients

The product contains no substances which at their given concentration, are considered to be hazardous to health

Chemical name	CAS No.	Weight-%
Non-hazardous ingredients	Proprietary	Balance

Section 4: First aid measures

Description of first aid measures

Inhalation Remove to fresh air.

Eye contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a doctor.

Skin contact Wash skin with soap and water.

Ingestion Rinse mouth.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Effects of Exposure No information available.

Indication of any immediate medical attention and special treatment needed

Note to doctors Treat symptomatically.

Section 5: Firefighting measures

Suitable Extinguishing Media

Suitable extinguishing media Water fog, carbon dioxide, foam, dry chemical.

Large Fire CAUTION: Use of water spray when fighting fire may be inefficient.

Unsuitable extinguishing media Do not scatter spilled material with high pressure water streams.

Specific hazards arising from the chemical

Specific hazards arising from the chemical No information available.

Oxides of sulfur. Carbon monoxide and carbon dioxide.

Special protective actions for fire-fighters

Special protective equipment and precautions for fire-fighters Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions	Ensure adequate ventilation.
For emergency responders	Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions	See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so.

Precautions to prevent secondary hazards

Prevention of secondary hazards	Clean contaminated objects and areas thoroughly observing environmental regulations.

Section 7: Handling and storage, including how the chemical may be safely used

Precautions for safe handling

Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice.
General hygiene considerations	If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

Conditions for safe storage, including any incompatibilities

Storage Conditions	Store away from oxidizers. Store in a cool well ventilated area. Keep container closed when not in use.
Incompatible materials	Strong oxidizers.

Section 8: Exposure controls and personal protection

Working area parameters, subject to mandatory control (MAC or TSEL)

Exposure Limits	This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.
Biological occupational exposure limits	This product, as supplied, does not contain any hazardous materials with biological limits established by the region specific regulatory bodies

Appropriate engineering controls

Engineering controls	Use in a well ventilated area.

Individual protection measures, such as personal protective equipment

Eye/face protection	Safety glasses with side-shields. If splashes are likely to occur, wear: Goggles, Face-shield. (EN-166).
Skin and body protection	Normal work coveralls.

Hand protection	Suitable materials for longer, direct contact (recommended: protection index 6, corresponding to > 480 minutes permeation time as per EN 374):. Normal work gloves.
Respiratory protection	If engineering controls and work practices cannot keep exposure below occupational exposure limits or if exposure is unknown, wear a NIOSH certified, European Standard EN 149, AS/NZS 1715:2009, or equivalent respirator when using this product. Selection of and instruction on using all personal protective equipment, including respirators, should be performed by an Industrial Hygienist or other qualified professional. Dust/mist respirator. (N95, P2/P3).
Environmental exposure controls	No information available.
Other protective equipment	Eyewash fountains and safety showers must be easily accessible.
Thermal hazards	No information available.

Section 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state	Liquid
Appearance	No information available
Colour	Red
Odour	Musty.
Odour threshold	No information available

Property	**Values**	**Remarks • Method**
pH	7	
Melting point / freezing point	No data available	
Initial boiling point and boiling range		
Flash point	> 97.8 °C / 208 °F	(PMCC)
Evaporation rate	No data available	
Flammability	No data available	
Flammability Limit in Air		
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapour pressure	No data available	
Relative vapour density	No data available	
Relative density	1.17	
Water solubility	Soluble in water	
Solubility(ies)	No data available	
Partition coefficient	No data available	
Autoignition temperature	No data available	
Decomposition temperature		
Kinematic viscosity	No data available	
Dynamic viscosity	No data available	
Other information		
Pour Point	No data available	
VOC content	No information available	
Liquid Density	9.75 lbs/gal	
Particle characteristics	No information available	

Section 10: Stability and reactivity

Reactivity

Reactivity	No information available.

Chemical stability

Stability Stable under normal conditions.

Explosion data
Sensitivity to mechanical impact None.
Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid None known based on information supplied.

Incompatible materials

Incompatible materials Strong oxidizers.

Hazardous decomposition products

Hazardous decomposition products Oxides of sulfur. Carbon monoxide and carbon dioxide.

Section 11: Toxicological information

Information on likely routes of exposure

Principle Routes of Exposure Eye or skin contact, inhalation, Ingestion, Skin contact, Eye contact, Inhalation

Product Information

Inhalation Specific test data for the substance or mixture is not available.

Eye contact Specific test data for the substance or mixture is not available.

Skin contact Specific test data for the substance or mixture is not available.

Ingestion Specific test data for the substance or mixture is not available.

Symptoms No information available.

Acute toxicity .

Numerical measures of toxicity - Product Information
No information available

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	99,999.00	mg/kg
ATEmix (dermal)	99,999.00	mg/kg
ATEmix (inhalation-gas)	99,999.00	ppm
ATEmix (inhalation-vapour)	99,999.00	mg/l
ATEmix (inhalation-dust/mist)	99,999.00	mg/l

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation No information available.

Serious eye damage/eye irritation	No information available.
Respiratory or skin sensitisation	No information available.
Germ cell mutagenicity	No information available.
Carcinogenicity	No information available.
Reproductive toxicity	No information available.
STOT - single exposure	No information available.
STOT - repeated exposure	No information available.
Aspiration hazard	No information available.

Section 12: Ecological information

Ecotoxicity Based on available data, the classification criteria are not met

Aquatic ecotoxicity

Terrestrial ecotoxicity	There is no data for this product.
Persistence and degradability	No information available
Bioaccumulation	No information available.
Mobility	No information available
Other adverse effects	No data available

Section 13: Disposal considerations

Disposal methods

Waste from residues/unused products	Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.
Contaminated packaging	Do not reuse empty containers.

See section 8 for more information

Section 14: Transport information

ADG Not regulated

IATA Not regulated

IMDG Not regulated

Transport in bulk according to Annex II of MARPOL and the IBC Code
No information available

Section 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
No poisons schedule number allocated

Australian Industrial Chemicals Introduction Scheme (AICIS)
Contact supplier for inventory compliance status

Illicit Drug Precursors/Reagents
This product does not contain any substance(s) on the Illicit Drug Precursors/Reagents list.

International Inventories

TSCA	All components listed on inventory or are exempt
AIIC	All components listed on inventory or are exempt
NZIoC	All components listed on inventory or are exempt

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
AIIC - Australian Inventory of Industrial Chemicals
NZIoC - New Zealand Inventory of Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Not applicable

Section 16: Any other relevant information

Revision date 12-Aug-2025

Reason for revision Update to Format

Key or legend to abbreviations and acronyms used in the safety data sheet

ADR - The European Agreement concerning the International Carriage of Dangerous Goods by Road
bw – body weight
CAS – Chemical Abstracts Service
CLP – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Classification, Labelling and Packaging of substances and mixtures
EN 149 - European standard on filtering halfmasks to protect against particles
FFP - Filtering Facepieces
h - hour
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LL50 – Lethal Loading 50%
d - day
Derived No Effect Level (DNEL)
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
IATA/ICAO - International Air Transport Association / International Civil Aviation Organization
IMDG/IMO - International Maritime Dangerous Goods / International Maritime Organization
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
REACH – REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
VOC – Volatile Organic Carbon
UN – United Nations
VLA-EC - short-time excursion limits [Spain valores límite ambientales para la exposición de corta duración]
vPvB – very Persistent and very Bioaccumulative
w/w - weight/weight
Water hazard class (WGK)
UN – United Nations
VOC – Volatile Organic Carbon
TWA - Time-Weighted Average
STEL – Short Term Exposure Limit

Legend Section 8: Exposure controls/personal protection

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	Sk*	Skin designation
+	Sensitisers		

Key literature references and sources for data used to compile the SDS

Acute Exposure Guideline Level(s) (AEGL(s))
European Chemicals Agency (ECHA) (ECHA_API)
European Chemicals Agency (ECHA) Committee for Risk Assessment (ECHA_RAC)
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
NIOSH (National Institute for Occupational Safety and Health)

Disclaimer

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information isobtained from various sources including the manufacturer and other third party sources. The information may not be validunder all conditions nor if this material is used in combination with other materials or in any process. Final determination ofsuitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

D-AIR 3000L

Revision date: 08-Aug-2025 **Revision Number:** 33

Section 1: Identification: Product identifier and chemical identity

Product identifier

Product Name D-AIR 3000L

Product Code(s) HM003191

Other means of identification

Pure substance/mixture Mixture

Recommended use of the chemical and restrictions on use

Recommended use Defoamer
Uses advised against No information available.

Details of manufacturer or importer

Halliburton Australia Pty. Ltd.
15 Marriott Road, Jandakot, WA 6164
Australia
ACN Number: 009 000 775
Telephone Number: + 61 (08) 6424 4800

For further information, please contact

fdunexchem@halliburton.com

Emergency telephone number

Australia Emergency Telephone Number + 61 1 800 686 951
Global Incident Response Access Code: 334305
Contract Number: 14012

Australian Poisons Information Centre 24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

Section 2: Hazard(s) identification

Statement of Hazardous Nature: Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

GHS Classification

Aspiration hazard	Category 1

Label elements



Signal word
DANGER

Hazard statements
May be fatal if swallowed and enters airways.
Repeated exposure may cause skin dryness or cracking

Precautionary Statements - Response

IF SWALLOWED: Immediately call a POISON CENTER or doctor.
Do NOT induce vomiting.
Precautionary Statements - Storage
Store locked up.
Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant.

Other hazards which do not result in classification
No information available.

Section 3: Composition/information on ingredients

Chemical name	CAS No.	Weight-%
Alkenes, C15-C18	93762-80-2	60 - 100%
Non-hazardous ingredients	Proprietary	Balance

If CAS number is "proprietary", the specific chemical identity and percentage of composition has been withheld as a trade secret

Section 4: First aid measures

Description of first aid measures

General advice Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.

Inhalation Aspiration into lungs can produce severe lung damage. If breathing has stopped, give artificial respiration. Get medical attention immediately. Remove to fresh air. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation. If breathing is difficult, (trained personnel should) give oxygen. Delayed pulmonary edema may occur.

Eye contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a doctor.

Skin contact Wash skin with soap and water.

Ingestion ASPIRATION HAZARD IF SWALLOWED - CAN ENTER LUNGS AND CAUSE DAMAGE. Do NOT induce vomiting. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. Rinse mouth. Never give anything by mouth to an unconscious person. Get immediate medical attention.

Most important symptoms and effects, both acute and delayed

Symptoms Difficulty in breathing. Coughing and/ or wheezing. Dizziness.

Effects of Exposure No information available.

Indication of any immediate medical attention and special treatment needed

Note to doctors Because of the danger of aspiration, emesis or gastric lavage should not be used unless the

risk is justified by the presence of additional toxic substances.

Section 5: Firefighting measures

Suitable Extinguishing Media

Suitable extinguishing media Water fog, carbon dioxide, foam, dry chemical.

Large Fire CAUTION: Use of water spray when fighting fire may be inefficient.

Unsuitable extinguishing media Do not scatter spilled material with high pressure water streams.

Specific hazards arising from the chemical

Specific hazards arising from the chemical No information available.

Carbon monoxide and carbon dioxide.

Special protective actions for fire-fighters

Special protective equipment and precautions for fire-fighters Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation. Use personal protective equipment as required.

Other information Refer to protective measures listed in Sections 7 and 8.

For emergency responders Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Precautions to prevent secondary hazards

Prevention of secondary hazards Clean contaminated objects and areas thoroughly observing environmental regulations.

Section 7: Handling and storage, including how the chemical may be safely used

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Conditions Store away from oxidizers. Keep container closed when not in use. Product has a shelf life of 24 months. Keep containers tightly closed in a dry, cool and well-ventilated place. Store locked up. Keep out of the reach of children. Store away from other materials.

Incompatible materials Strong oxidizers.

Section 8: Exposure controls and personal protection

Working area parameters, subject to mandatory control (MAC or TSEL)

Exposure Limits	This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.
Biological occupational exposure limits	This product, as supplied, does not contain any hazardous materials with biological limits established by the region specific regulatory bodies

Appropriate engineering controls

Engineering controls	Use in a well ventilated area.

Individual protection measures, such as personal protective equipment

Eye/face protection	Wear safety glasses or goggles to protect against exposure. (EN-166). If splashes are likely to occur, wear safety glasses with side-shields.
Skin and body protection	Normal work coveralls.
Hand protection	Suitable materials for longer, direct contact (recommended: protection index 6, corresponding to > 480 minutes permeation time as per EN 374):. Nitrile gloves.
Respiratory protection	Not normally necessary.
Environmental exposure controls	No information available.
Other protective equipment	Eyewash fountains and safety showers must be easily accessible.
Thermal hazards	No information available.

Section 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state	Liquid
Appearance	No information available
Colour	Opaque
Odour	Hydrocarbon.
Odour threshold	No information available

Property	**Values**	**Remarks • Method**
pH	5.5 - 7.9	
Melting point / freezing point	No data available	
Initial boiling point and boiling range		
Flash point	> 121.1 °C / 250 °F	(PMCC)
Evaporation rate	No data available	
Flammability	No data available	
Flammability Limit in Air		
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapour pressure	No data available	
Relative vapour density	No data available	
Relative density	0.92	
Water solubility	Insoluble in water	

Solubility(ies)	No data available
Partition coefficient	No data available
Autoignition temperature	No data available
Decomposition temperature	
Kinematic viscosity	No data available
Dynamic viscosity	No data available
Other information	
Pour Point	No data available
VOC content	No information available
Particle characteristics	No information available

Section 10: Stability and reactivity

Reactivity

Reactivity No information available.

Chemical stability

Stability Stable under normal conditions.

Explosion data

Sensitivity to mechanical impact None.
Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid None known based on information supplied.

Incompatible materials

Incompatible materials Strong oxidizers.

Hazardous decomposition products

Hazardous decomposition products Carbon monoxide and carbon dioxide.

Section 11: Toxicological information

Information on likely routes of exposure

Principle Routes of Exposure Ingestion, Skin contact, Eye contact, Inhalation

Product Information

Inhalation Specific test data for the substance or mixture is not available. Aspiration into lungs can produce severe lung damage. May cause pulmonary edema. Pulmonary edema can be fatal. May cause irritation of respiratory tract.

Eye contact Specific test data for the substance or mixture is not available. May cause irritation.

Skin contact Repeated exposure may cause skin dryness or cracking.

Ingestion Specific test data for the substance or mixture is not available. Potential for aspiration if swallowed. May cause lung damage if swallowed. Aspiration may cause pulmonary edema and pneumonitis. May be fatal if swallowed and enters airways.

Symptoms Difficulty in breathing. Coughing and/ or wheezing. Dizziness.

Acute toxicity .

Numerical measures of toxicity - Product Information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	99,999.00	mg/kg
ATEmix (dermal)	99,999.00	mg/kg
ATEmix (inhalation-gas)	99,999.00	ppm
ATEmix (inhalation-vapour)	99,999.00	mg/l
ATEmix (inhalation-dust/mist)	99,999.00	mg/l

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Alkenes, C15-C18	> 5000 mg/kg (Rat) (similar substance)	> 2000 mg/kg (Rat) (similar substance)	40.2 mg/L (Rat) (4h, vapor)

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation

Chemical name	**Skin corrosion/irritation**
Alkenes, C15-C18 93762-80-2	Not irritating to skin in rabbits. (similar substances)

Serious eye damage/eye irritation

Chemical name	**Serious eye damage/eye irritation**
Alkenes, C15-C18 93762-80-2	Non-irritating to rabbit's eye (similar substances)

Respiratory or skin sensitisation

Chemical name	Respiratory sensitisation
Alkenes, C15-C18 93762-80-2	No information available
Chemical name	**Skin sensitisation**
Alkenes, C15-C18 93762-80-2	Did not cause sensitisation on laboratory animals (similar substances)

Germ cell mutagenicity

Chemical name	**Germ cell mutagenicity**
Alkenes, C15-C18 93762-80-2	In vitro tests did not show mutagenic effects. (similar substances)

Carcinogenicity

Chemical name	**Carcinogenicity**
Alkenes, C15-C18 93762-80-2	No information available

Reproductive toxicity

Chemical name	**Reproductive toxicity**
Alkenes, C15-C18	Animal testing did not show any effects on fertility. Did not show teratogenic effects in

93762-80-2	animal experiments. (similar substances)

STOT - single exposure

Chemical name	STOT - single exposure
Alkenes, C15-C18 93762-80-2	No significant toxicity observed in animal studies at concentration requiring classification. (similar substances)

STOT - repeated exposure

Chemical name	STOT - repeated exposure
Alkenes, C15-C18 93762-80-2	No information available

Aspiration hazard May be fatal if swallowed and enters airways.

Chemical name	Aspiration hazard
Alkenes, C15-C18 93762-80-2	Aspiration into the lungs may cause chemical pneumonitis including coughing, difficulty breathing, wheezing, coughing up blood and pneumonia, which can be fatal.

Section 12: Ecological information

Ecotoxicity Based on available data, the classification criteria are not met

Aquatic ecotoxicity

Chemical name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Alkenes, C15-C18	EC50 (72h) > 1000 mg/L (Selenastrum capicomutum) (similar substance)	LL50 (96h) > 1000 mg/L (Oncorhynchus mykiss) (similar substance) LL50 (96h) > 10000 mg/L (Scopthalmus maximus) (similar substance)	-	EC50 (48h) > 1000 mg/L (Daphnia magna) (similar substance)

Terrestrial ecotoxicity There is no data for this product.

Persistence and degradability

Chemical name	Persistence and degradability
Alkenes, C15-C18 93762-80-2	Readily biodegradable (77 - 81% @ 28d)

Bioaccumulation There is no data for this product.

Mobility Based on available data, the classification criteria are not met

Chemical name	Mobility
Alkenes, C15-C18 93762-80-2	KOC >5

Other adverse effects No data available

Section 13: Disposal considerations

Disposal methods

Waste from residues/unused products	Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.
Contaminated packaging	Do not reuse empty containers.

See section 8 for more information

Section 14: Transport information

ADG	Not regulated
IATA	Not regulated
IMDG	Not regulated

Transport in bulk according to Annex II of MARPOL and the IBC Code
No information available

Section 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
No poisons schedule number allocated

Australian Industrial Chemicals Introduction Scheme (AICIS)

Chemical name	Australian Industrial Chemicals Introduction Scheme (AICIS)	Additional information
Alkenes, C15-C18 - 93762-80-2	Present	-

Illicit Drug Precursors/Reagents
This product does not contain any substance(s) on the Illicit Drug Precursors/Reagents list.

International Inventories

TSCA	All components listed on inventory or are exempt
AIIC	All components listed on inventory or are exempt
NZIoC	All components listed on inventory or are exempt

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
AIIC - Australian Inventory of Industrial Chemicals
NZIoC - New Zealand Inventory of Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Not applicable

Section 16: Any other relevant information

Revision date 08-Aug-2025

Reason for revision Update to Format SDS sections updated: 2

Key or legend to abbreviations and acronyms used in the safety data sheet

ADR - The European Agreement concerning the International Carriage of Dangerous Goods by Road
bw – body weight
CAS – Chemical Abstracts Service
CLP – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Classification, Labelling and Packaging of substances and mixtures
EN 149 - European standard on filtering halfmasks to protect against particles
FFP - Filtering Facepieces
h - hour
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LL50 – Lethal Loading 50%
d - day
Derived No Effect Level (DNEL)
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
IATA/ICAO - International Air Transport Association / International Civil Aviation Organization
IMDG/IMO - International Maritime Dangerous Goods / International Maritime Organization
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
REACH – REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
VOC – Volatile Organic Carbon
UN – United Nations
VLA-EC - short-time excursion limits [Spain valores límite ambientales para la exposición de corta duración]
vPvB – very Persistent and very Bioaccumulative
w/w - weight/weight
Water hazard class (WGK)
UN – United Nations
VOC – Volatile Organic Carbon
TWA - Time-Weighted Average
STEL – Short Term Exposure Limit

Legend Section 8: Exposure controls/personal protection

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	Sk*	Skin designation
+	Sensitisers		

Key literature references and sources for data used to compile the SDS

Acute Exposure Guideline Level(s) (AEGL(s))
European Chemicals Agency (ECHA) (ECHA_API)
European Chemicals Agency (ECHA) Committee for Risk Assessment (ECHA_RAC)
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
NIOSH (National Institute for Occupational Safety and Health)

Disclaimer

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information isobtained from various sources including the manufacturer and other third party sources. The information may not be validunder all conditions nor if this material is used in combination with other materials or in any process. Final determination ofsuitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

ECONOLITE LIQUID

Revision date: 12-Aug-2025 **Revision Number:** 104

Section 1: Identification: Product identifier and chemical identity

Product identifier

Product Name ECONOLITE LIQUID

Product Code(s) HM000478

Other means of identification

Pure substance/mixture Mixture

Recommended use of the chemical and restrictions on use

Recommended use Light Weight Cement Additive
Uses advised against No information available.

Details of manufacturer or importer

Halliburton Australia Pty. Ltd.
15 Marriott Road, Jandakot, WA 6164
Australia
ACN Number: 009 000 775
Telephone Number: + 61 (08) 6424 4800

For further information, please contact

fdunexchem@halliburton.com

Emergency telephone number

Australia Emergency Telephone Number + 61 1 800 686 951
Global Incident Response Access Code: 334305
Contract Number: 14012

Australian Poisons Information Centre 24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

Section 2: Hazard(s) identification

Statement of Hazardous Nature: Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

GHS Classification

Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 1

Label elements



Signal word
DANGER

Hazard statements
Causes skin irritation.
Causes serious eye damage.

Precautionary Statements - Prevention
Wash face, hands and any exposed skin thoroughly after handling.
Wear protective gloves/clothing and eye/face protection.
IF ON SKIN: Wash with plenty of water and soap.
If skin irritation occurs: Get medical advice/attention.
Take off all contaminated clothing and wash it before reuse.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Immediately call a POISON CENTRE or doctor.

Other hazards which do not result in classification
No information available.

Section 3: Composition/information on ingredients

Chemical name	CAS No.	Weight-%
Sodium silicate	1344-09-8	30 - 60%
Non-hazardous ingredients	Proprietary	Balance

If CAS number is "proprietary", the specific chemical identity and percentage of composition has been withheld as a trade secret

Section 4: First aid measures

Description of first aid measures

General advice Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.

Inhalation Remove to fresh air. Get medical attention immediately if symptoms occur.

Eye contact Get immediate medical attention. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Keep eye wide open while rinsing. Do not rub affected area.

Skin contact Wash off immediately with soap and plenty of water for at least 15 minutes. Get medical attention if irritation develops and persists.

Ingestion Rinse mouth. Never give anything by mouth to an unconscious person. Do NOT induce vomiting. Call a doctor.

Most important symptoms and effects, both acute and delayed

Symptoms Burning sensation.

Effects of Exposure No information available.

Indication of any immediate medical attention and special treatment needed

Note to doctors Treat symptomatically.

Section 5: Firefighting measures

Suitable Extinguishing Media

Suitable extinguishing media Water fog, carbon dioxide, foam, dry chemical.

Large Fire CAUTION: Use of water spray when fighting fire may be inefficient.

Unsuitable extinguishing media Do not scatter spilled material with high pressure water streams.

Specific hazards arising from the chemical

Specific hazards arising from the chemical No information available.

Hydrogen

Special protective actions for fire-fighters

Special protective equipment and precautions for fire-fighters Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions Avoid contact with skin, eyes or clothing. Use personal protective equipment as required. Ensure adequate ventilation.

Other information Refer to protective measures listed in Sections 7 and 8.

For emergency responders Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions Prevent further leakage or spillage if safe to do so.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Precautions to prevent secondary hazards

Prevention of secondary hazards Clean contaminated objects and areas thoroughly observing environmental regulations.

Section 7: Handling and storage, including how the chemical may be safely used

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Do not eat, drink or smoke when using this product. Take off contaminated clothing and wash it before reuse.

General hygiene considerations Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Do not eat, drink or smoke when using this product.

Conditions for safe storage, including any incompatibilities

Storage Conditions	Store away from acids. Store in a cool well ventilated area. Keep container closed when not in use. Keep containers tightly closed in a dry, cool and well-ventilated place. Store locked up. Keep out of the reach of children.
Incompatible materials	Strong acids. Amphoteric metals such as aluminum, magnesium, lead, tin, or zinc. Strong acids. Strong bases. Strong oxidising agents.

Section 8: Exposure controls and personal protection

Working area parameters, subject to mandatory control (MAC or TSEL)

Exposure Limits	This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.
Biological occupational exposure limits	This product, as supplied, does not contain any hazardous materials with biological limits established by the region specific regulatory bodies

Appropriate engineering controls

Engineering controls	Use in a well ventilated area. Local exhaust ventilation should be used in areas without good cross ventilation.

Individual protection measures, such as personal protective equipment

Eye/face protection	Chemical goggles; also wear a face shield if splashing hazard exists. (EN-166). Tight sealing safety goggles.
Skin and body protection	Wear protective clothing impervious to the chemical substance, including boots, gloves, lab coat, apron, rain jacket, pants or coverall, as appropriate, to prevent skin contact. Full protective chemical resistant clothing. Wear suitable protective clothing. Long sleeved clothing.
Hand protection	Chemical-resistant protective gloves (EN 374). Nitrile gloves. Suitable materials for longer, direct contact (recommended: protection index 6, corresponding to > 480 minutes permeation time as per EN 374):. (>= .? mm thickness) This information is based on literature references and on information provided by glove manufacturers, or is derived by analogy with similar substances. Please note that in practice the working life of chemical-resistant protective gloves may be considerably shorter than the permeation time determined in accordance with EN 374 as a result of the many influencing factors (e.g. temperature). If signs of wear and tear are noticed then the gloves should be replaced. Manufacturer's directions for use should be observed because of great diversity of types. Wear suitable gloves. Impervious gloves.
Respiratory protection	If engineering controls and work practices cannot keep exposure below occupational exposure limits or if exposure is unknown, wear a NIOSH certified, European Standard EN 149, AS/NZS 1715:2009, or equivalent respirator when using this product. Selection of and instruction on using all personal protective equipment, including respirators, should be performed by an Industrial Hygienist or other qualified professional. Dust/mist respirator. (N95, P2/P3).
Environmental exposure controls	No information available.
Other protective equipment	Eyewash fountains and safety showers must be easily accessible.
Thermal hazards	No information available.

Section 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state	Liquid
Appearance	No information available
Colour	Clear to hazy
Odour	Slightly soapy.
Odour threshold	No information available

Property	**Values**	**Remarks • Method**
pH	11.2	
Melting point / freezing point	-1.1 °C / 30 °F	
Initial boiling point and boiling range	101.1 °C / 214 °F	
Flash point	No data available	
Evaporation rate	No data available	
Flammability	No data available	
Flammability Limit in Air		
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapour pressure	No data available	
Relative vapour density	No data available	
Relative density	1.4	
Water solubility	Soluble in water	
Solubility(ies)	No data available	
Partition coefficient	No data available	
Autoignition temperature	No data available	
Decomposition temperature		
Kinematic viscosity	No data available	
Dynamic viscosity	No data available	
Other information		
Pour Point	No data available	
VOC content	No information available	
Particle characteristics	No information available	

Section 10: Stability and reactivity

Reactivity

Reactivity No information available.

Chemical stability

Stability Stable under normal conditions.

Explosion data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid None known based on information supplied.

Incompatible materials

Incompatible materials Strong acids. Amphoteric metals such as aluminum, magnesium, lead, tin, or zinc. Strong acids. Strong bases. Strong oxidising agents.

Hazardous decomposition products

Hazardous decomposition products Hydrogen.

Section 11: Toxicological information

Information on likely routes of exposure

Principle Routes of Exposure Ingestion, Skin contact, Eye contact, Inhalation

Product Information

Inhalation Specific test data for the substance or mixture is not available. May cause irritation of respiratory tract.

Eye contact Specific test data for the substance or mixture is not available. Causes serious eye damage. May cause irreversible damage to eyes.

Skin contact Specific test data for the substance or mixture is not available. Causes skin irritation. (based on components).

Ingestion Specific test data for the substance or mixture is not available. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.

Symptoms Redness. Burning. May cause blindness. May cause redness and tearing of the eyes.

Acute toxicity .

Numerical measures of toxicity - Product Information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	99,999.00 mg/kg
ATEmix (dermal)	99,999.00 mg/kg
ATEmix (inhalation-gas)	99,999.00 ppm
ATEmix (inhalation-vapour)	99,999.00 mg/l
ATEmix (inhalation-dust/mist)	99,999.00 mg/l

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Sodium silicate	3400 mg/kg (Rat)	> 5000 mg/kg (Rat) (similar substance)	> 2.06 mg/L (Rat) 4h (similar substance)

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation Classification based on data available for ingredients. Causes skin irritation.

Chemical name	Skin corrosion/irritation
Sodium silicate 1344-09-8	May cause moderate skin irritation. (Rabbit)

Serious eye damage/eye irritation Classification based on data available for ingredients. Causes burns. Causes serious eye damage.

Chemical name	Serious eye damage/eye irritation
Sodium silicate 1344-09-8	Causes severe eye irritation which may damage tissue. (Rabbit)

Respiratory or skin sensitisation

Chemical name	Respiratory sensitisation
Sodium silicate 1344-09-8	Based on available data, the classification criteria are not met
Chemical name	**Skin sensitisation**
Sodium silicate 1344-09-8	Did not cause sensitisation on laboratory animals (mouse) (similar substances)

Germ cell mutagenicity

Chemical name	**Germ cell mutagenicity**
Sodium silicate 1344-09-8	In vitro tests did not show mutagenic effects. In vivo tests did not show mutagenic effects.

Carcinogenicity

Chemical name	**Carcinogenicity**
Sodium silicate 1344-09-8	Based on available data, the classification criteria are not met

Reproductive toxicity

Chemical name	**Reproductive toxicity**
Sodium silicate 1344-09-8	Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments. (similar substances)

STOT - single exposure

Chemical name	**STOT - single exposure**
Sodium silicate 1344-09-8	Based on available data, the classification criteria are not met

STOT - repeated exposure

Chemical name	**STOT - repeated exposure**
Sodium silicate 1344-09-8	No significant toxicity observed in animal studies at concentration requiring classification.

Aspiration hazard

Chemical name	**Aspiration hazard**
Sodium silicate 1344-09-8	Not applicable

Section 12: Ecological information

Ecotoxicity Based on available data, the classification criteria are not met

Aquatic ecotoxicity

Chemical name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Sodium silicate	EC50 (72h) > 345 mg/L (growth rate) (Scenedesmus	LC50 (96h) 1108 mg/L (Danio rerio) LC50 (96h) 260 – 310	EC0 (0.5h) 3454 mg/L (Pseudomonas putida)	EC50 (48h) 1700 mg/L (Daphnia magna)

	subspicatus) EC0 (72h) 35 mg/L (growth rate) (Scenedesmus subspicatus)	mg/L (Oncorhynchus mykiss)		

Terrestrial ecotoxicity There is no data for this product.

Persistence and degradability

Chemical name	Persistence and degradability
Sodium silicate 1344-09-8	The methods for determining biodegradability are not applicable to inorganic substances.

Bioaccumulation

Mobility Based on available data, the classification criteria are not met

Chemical name	Mobility
Sodium silicate 1344-09-8	No information available

Other adverse effects No data available

Section 13: Disposal considerations

Disposal methods

Waste from residues/unused products Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.

Contaminated packaging Do not reuse empty containers.

See section 8 for more information

Section 14: Transport information

ADG Not regulated

IATA Not regulated

IMDG Not regulated

Transport in bulk according to Annex II of MARPOL and the IBC Code
No information available

Section 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
Classified as a scheduled poison according to the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
Poison Schedule Number 10

Australian Industrial Chemicals Introduction Scheme (AICIS)

Chemical name	Australian Industrial Chemicals Introduction Scheme (AICIS)	Additional information
Sodium silicate - 1344-09-8	Present	-

Illicit Drug Precursors/Reagents
This product does not contain any substance(s) on the Illicit Drug Precursors/Reagents list.

International Inventories

TSCA	All components listed on inventory or are exempt
AIIC	All components listed on inventory or are exempt
NZIoC	All components listed on inventory or are exempt

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
AIIC - Australian Inventory of Industrial Chemicals
NZIoC - New Zealand Inventory of Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Not applicable

Section 16: Any other relevant information

Revision date 12-Aug-2025

Reason for revision Update to Format

Key or legend to abbreviations and acronyms used in the safety data sheet
ADR - The European Agreement concerning the International Carriage of Dangerous Goods by Road
bw – body weight
CAS – Chemical Abstracts Service
CLP – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Classification, Labelling and Packaging of substances and mixtures
EN 149 - European standard on filtering halfmasks to protect against particles
FFP - Filtering Facepieces
h - hour
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LL50 – Lethal Loading 50%
d - day
Derived No Effect Level (DNEL)

EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
IATA/ICAO - International Air Transport Association / International Civil Aviation Organization
IMDG/IMO - International Maritime Dangerous Goods / International Maritime Organization
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
REACH – REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
VOC – Volatile Organic Carbon
UN – United Nations
VLA-EC - short-time excursion limits [Spain valores límite ambientales para la exposición de corta duración]
vPvB – very Persistent and very Bioaccumulative
w/w - weight/weight
Water hazard class (WGK)
UN – United Nations
VOC – Volatile Organic Carbon
TWA - Time-Weighted Average
STEL – Short Term Exposure Limit

Legend Section 8: Exposure controls/personal protection

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	Sk*	Skin designation
+	Sensitisers		

Key literature references and sources for data used to compile the SDS

Acute Exposure Guideline Level(s) (AEGL(s))
European Chemicals Agency (ECHA) (ECHA_API)
European Chemicals Agency (ECHA) Committee for Risk Assessment (ECHA_RAC)
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
NIOSH (National Institute for Occupational Safety and Health)

Disclaimer

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End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

SODIUM FLUORESCEIN POWDER

Revision Date: 15-Mar-2022 **Revision Number:** 5

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature Non-Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

1.1. Product Identifier

Product Name SODIUM FLUORESCEIN POWDER

Other means of Identification

Synonyms None

Hazardous Material Number: HM007136

Recommended use of the chemical and restrictions on use

Recommended Use Dye

Uses advised against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road, Jandakot, WA 6164
Australia
ACN Number: 009 000 775
Telephone Number: + 61 1 800 686 951
Fax Number: 61 (08) 9455 5300

E-mail Address fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951
Global Incident Response Access Code: 334305
Contract Number: 14012

Australian Poisons Information Centre
24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature Non-Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

Classification of the hazardous chemical

Not classified

Label elements, including precautionary statements

Hazard Pictograms

Signal Word Not Hazardous

Hazard Statements: Not Classified

Precautionary Statements

Prevention None
Response None
Storage None
Disposal None

Contains

Substances	**CAS Number**
Sodium fluorescein	518-47-8

Other hazards which do not result in classification
None known

For the full text of the H-phrases mentioned in this Section, see Section 16

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Sodium fluorescein	518-47-8	60 - 100%	Not classified

4. First aid measures

Description of necessary first aid measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Skin Wash with soap and water.

Ingestion Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

Symptoms caused by exposure
No significant hazards expected.

Medical Attention and Special Treatment
Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment
Suitable Extinguishing Media
All standard fire fighting media
Extinguishing media which must not be used for safety reasons
None known.

Specific hazards arising from the chemical
Special exposure hazards in a fire
Decomposition in fire may produce harmful gases.

Special protective equipment and precautions for fire fighters
Special protective equipment for firefighters
Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures
Use appropriate protective equipment. Avoid creating and breathing dust.

6.2. Environmental precautions
None known.

6.3. Methods and material for containment and cleaning up
Scoop up and remove.

7. Handling and storage

7.1. Precautions for safe handling
Handling Precautions
Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust.
Hygiene Measures
Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities
Storage Information
Store away from acids. Store in a cool, dry location.
Other Guidelines
No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring
Exposure Limits

Substances	CAS Number	Australia NOHSC	ACGIH TLV-TWA
Sodium fluorescein	518-47-8	Not applicable	Not applicable

Appropriate engineering controls
Engineering Controls Use in a well ventilated area.

Personal protective equipment (PPE)
Personal Protective Equipment If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.
Respiratory Protection Dust/mist respirator. (N95, P2/P3)
Hand Protection Normal work gloves.
Skin Protection Normal work coveralls.
Eye Protection Wear safety glasses or goggles to protect against exposure.
Other Precautions None known.
Environmental Exposure Controls No information available

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties
Physical State: Solid
Odor: Odorless
Color Red-orange
Odor Threshold: No information available

Property	Values	Remarks/ - Method
pH:	No data available	
Freezing Point / Range	No data available	
Melting Point / Range	No data available	

Pour Point / Range	No data available
Boiling Point / Range	290 °C / 554 °F
Flash Point	No data available
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	No data available
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

Molecular Weight	376.28
VOC Content (%)	No data available

10. Stability and Reactivity

10.1. Reactivity
Not expected to be reactive.
10.2. Chemical stability
Stable
10.3. Possibility of hazardous reactions
Will Not Occur
10.4. Conditions to avoid
None anticipated
10.5. Incompatible materials
Strong acids.
10.6. Hazardous decomposition products
Hydrogen fluoride.

11. Toxicological Information

Information on routes of exposure
Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure
Most Important Symptoms/Effects
No significant hazards expected.

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sodium fluorescein	518-47-8	6721 mg/kg (Rat) 2500 mg/kg (Rabbit) 4738 mg/kg (Mouse)	No data available	No data available

Immediate, delayed and chronic health effects from exposure

Inhalation	May cause mild respiratory irritation.
Eye Contact	May cause mild eye irritation.
Skin Contact	Prolonged or repeated contact may cause slight skin irritation.
Ingestion	May cause damage to bones and teeth.

Chronic Effects/Carcinogenicity No data available to indicate product or components present at greater than 0.1% are chronic health hazards.

Exposure Levels

No data available

Interactive effects
None known.

Data limitations
No data available

Substances	CAS Number	Skin corrosion/irritation
Sodium fluorescein	518-47-8	Substance may cause slight skin irritation

Substances	CAS Number	Serious eye damage/irritation
Sodium fluorescein	518-47-8	May cause mild eye irritation.

Substances	CAS Number	Skin Sensitization
Sodium fluorescein	518-47-8	No information available

Substances	CAS Number	Respiratory Sensitization
Sodium fluorescein	518-47-8	No information available

Substances	CAS Number	Mutagenic Effects
Sodium fluorescein	518-47-8	In vitro tests did not show mutagenic effects.

Substances	CAS Number	Carcinogenic Effects
Sodium fluorescein	518-47-8	No data of sufficient quality are available.

Substances	CAS Number	Reproductive toxicity
Sodium fluorescein	518-47-8	Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments.

Substances	CAS Number	STOT - single exposure
Sodium fluorescein	518-47-8	No data of sufficient quality are available.

Substances	CAS Number	STOT - repeated exposure
Sodium fluorescein	518-47-8	No data of sufficient quality are available.

Substances	CAS Number	Aspiration hazard
Sodium fluorescein	518-47-8	Not applicable

12. Ecological Information

Ecotoxicity

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Sodium fluorescein	518-47-8	No information available	LC50 (96h) 997 mg/L (Psetta maxima) LC50 (96h) 1372 mg/L (Oncorhynchus mykiss) LC50 (96h) 2267 mg/L (Ictalurus punctatus) LC50 (96h) 3433 mg/L (Lepomis macrochirus)	No information available	LC50 (48h) 337 mg/L (Daphnia pulex)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Sodium fluorescein	518-47-8	Readily biodegradable (100% @ 20d)

12.3. Bioaccumulative potential

Substances	CAS Number	Bioaccumulation
Sodium fluorescein	518-47-8	Log Kow = -0.67 (estimated)

12.4. Mobility in soil

Substances	CAS Number	Mobility
Sodium fluorescein	518-47-8	KOC = < 2

12.6. Other adverse effects

Endocrine Disruptor Information

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Safe handling and disposal methods

Bury in a licensed landfill according to federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations.

Environmental regulations

Not applicable

14. Transport Information

Transportation Information

Australia ADG

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

IMDG/IMO

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

IATA/ICAO

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product

International Inventories

Australian AICS Inventory	All components are listed on the AIIC or are subject to a relevant exemption, permit, or assessment certificate.
New Zealand Inventory of Chemicals	All components are listed on the NZIoC or are subject to a relevant exemption, permit, or assessment certificate.
US TSCA Inventory	All components listed on inventory or are exempt.
Canadian Domestic Substances List (DSL)	All components listed on inventory or are exempt.

Poisons Schedule number
None Allocated

International Agreements

Montreal Protocol - Ozone Depleting Substances:	Does not apply.
Stockholm Convention - Persistent Organic Pollutants:	Does not apply
Rotterdam Convention - Prior Informed Consent:	Does not apply.
Basel Convention - Hazardous Waste:	Does not apply.

16. Other information

Date of preparation or review

Revision Date: 15-Mar-2022

Revision Note
SDS sections updated:
2

Full text of H-Statements referred to under sections 2 and 3
None

Additional information: For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Safety Data Sheet for this or other Halliburton products, contact Chemical Stewardship at 1-580-251-4335.

Key abreviations or acronyms used
bw – body weight
CAS – Chemical Abstracts Service
EC50 – Effective Concentration 50%
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
NOEC – No Observed Effect Concentration
OEL – Occupational Exposure Limit
PBT – Persistent Bioaccumulative and Toxic
ppm – parts per million
STEL – Short Term Exposure Limit
TWA – Time-Weighted Average
vPvB – very Persistent and very Bioaccumulative
h - hour
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
w/w - weight/weight
d - day

Key literature references and sources for data
www.ChemADVISOR.com/

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End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

GASCON 469

Revision date: 30-Apr-2025 **Revision Number:** 34

Section 1: Identification: Product identifier and chemical identity

Product identifier

Product Name GASCON 469

Product Code(s) HM000753

Other means of identification

Pure substance/mixture Substance

Recommended use of the chemical and restrictions on use

Recommended use Cement Additive
Uses advised against No information available.

Illicit Drug Precursors/Reagents This product contains one or more substance(s) on the Illicit Drug Precursors/Reagents list. Verify requirements related to using, handling, and storing these substances.

Details of manufacturer or importer

Halliburton Australia Pty. Ltd.
15 Marriott Road, Jandakot, WA 6164
Australia
ACN Number: 009 000 775
Telephone Number: + 61 (08) 6424 4800

For further information, please contact

fdunexchem@halliburton.com

Emergency telephone number

Australia Emergency Telephone Number + 61 1 800 686 951
Global Incident Response Access Code: 334305
Contract Number: 14012

Australian Poisons Information Centre 24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

Section 2: Hazard(s) identification

Statement of Hazardous Nature: Non-Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

GHS Classification

Not a hazardous substance or mixture according to the Globally Harmonised System (GHS). Not classified.

Chronic aquatic toxicity	Not classified chronic

Label elements

Hazard statements

Not a hazardous substance or mixture according to the Globally Harmonised System (GHS). Not classified.

Other hazards which do not result in classification
Causes mild skin irritation.
Harmful to aquatic life.

Section 3: Composition/information on ingredients

Non-hazardous ingredients	Proprietary	Balance

If CAS number is "proprietary", the specific chemical identity and percentage of composition has been withheld as a trade secret

Section 4: First aid measures

Description of first aid measures

Inhalation Remove to fresh air.

Eye contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a doctor.

Skin contact Wash skin with soap and water.

Ingestion Rinse mouth.

Most important symptoms and effects, both acute and delayed

Symptoms Prolonged contact may cause redness and irritation.

Effects of Exposure No information available.

Indication of any immediate medical attention and special treatment needed

Note to doctors Treat symptomatically.

Section 5: Firefighting measures

Suitable Extinguishing Media

Suitable extinguishing media All standard fire fighting media.

Large Fire CAUTION: Use of water spray when fighting fire may be inefficient.

Unsuitable extinguishing media Do not scatter spilled material with high pressure water streams.

Specific hazards arising from the chemical

Specific hazards arising from the chemical No information available.

None known

Special protective actions for fire-fighters

Special protective equipment and precautions for fire-fighters Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation.

For emergency responders Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Precautions to prevent secondary hazards

Prevention of secondary hazards Clean contaminated objects and areas thoroughly observing environmental regulations.

Section 7: Handling and storage, including how the chemical may be safely used

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice.

General hygiene considerations If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

Conditions for safe storage, including any incompatibilities

Storage Conditions Store in a cool well ventilated area. Keep from excessive heat. Keep from freezing. Keep container closed when not in use. Store in non-rusting containers. Product has a shelf life of 12 months.

Incompatible materials Strong oxidizers. Strong acids.

Section 8: Exposure controls and personal protection

Working area parameters, subject to mandatory control (MAC or TSEL)

Exposure Limits

Biological occupational exposure limits This product, as supplied, does not contain any hazardous materials with biological limits established by the region specific regulatory bodies

Appropriate engineering controls

Engineering controls Use in a well ventilated area.

Individual protection measures, such as personal protective equipment

Eye/face protection Chemical goggles; also wear a face shield if splashing hazard exists. (EN-166). Wear safety

	glasses with side shields (or goggles).
Skin and body protection	Normal work coveralls. Wear suitable protective clothing.
Hand protection	None known. Wear suitable gloves.
Respiratory protection	If engineering controls and work practices cannot keep exposure below occupational exposure limits or if exposure is unknown, wear a NIOSH certified, European Standard EN 149, AS/NZS 1715:2009, or equivalent respirator when using this product. Selection of and instruction on using all personal protective equipment, including respirators, should be performed by an Industrial Hygienist or other qualified professional. Dust/mist respirator. (N95, P2/P3).
Environmental exposure controls	No information available.
Other protective equipment	Eyewash fountains and safety showers must be easily accessible.
Thermal hazards	No information available.

Section 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state	Liquid
Appearance	No information available
Colour	Transparent
Odour	Odourless.
Odour threshold	No information available

Property	**Values**	**Remarks • Method**
pH	10	
Melting point / freezing point	No data available	
Initial boiling point and boiling range	100 °C / 212 °F	
Flash point	No data available	
Evaporation rate	No data available	
Flammability	No data available	
Flammability Limit in Air		
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapour pressure	No data available	
Relative vapour density	No data available	
Relative density	1.1	
Water solubility	Soluble in water (10g/100ml)	
Solubility(ies)	No data available	
Partition coefficient	No data available	
Autoignition temperature	No data available	
Decomposition temperature		
Kinematic viscosity	No data available	
Dynamic viscosity	No data available	
Other information		
Pour Point	No data available	
VOC content	.?	
Particle characteristics	No information available	

Section 10: Stability and reactivity

Reactivity

Reactivity	No information available.

Chemical stability

Stability Stable under normal conditions.

Explosion data
Sensitivity to mechanical impact None.
Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid None known based on information supplied.

Incompatible materials

Incompatible materials Strong oxidizers. Strong acids.

Hazardous decomposition products

Hazardous decomposition products None known.

Section 11: Toxicological information

Information on likely routes of exposure

Principle Routes of Exposure Eye or skin contact, inhalation, Ingestion, Skin contact, Eye contact, Inhalation

Product Information

Inhalation Specific test data for the substance or mixture is not available.

Eye contact Specific test data for the substance or mixture is not available.

Skin contact Specific test data for the substance or mixture is not available. Causes mild skin irritation.

Ingestion Specific test data for the substance or mixture is not available.

Symptoms Prolonged contact may cause redness and irritation.

Acute toxicity .

Numerical measures of toxicity - Product Information

Component Information
See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation Classification based on data available for ingredients. Causes mild skin irritation.

Serious eye damage/eye irritation Based on available data, the classification criteria are not met.

Respiratory or skin sensitisation Based on available data, the classification criteria are not met.

Germ cell mutagenicity	Based on available data, the classification criteria are not met.
Carcinogenicity	Based on available data, the classification criteria are not met.
Reproductive toxicity	Based on available data, the classification criteria are not met.
STOT - single exposure	Based on available data, the classification criteria are not met.
STOT - repeated exposure	Based on available data, the classification criteria are not met.
Aspiration hazard	Based on available data, the classification criteria are not met.

Section 12: Ecological information

Ecotoxicity	Based on available data, the classification criteria are not met
Aquatic ecotoxicity	Harmful to aquatic life.
Terrestrial ecotoxicity	There is no data for this product.
Persistence and degradability	Based on available data, the classification criteria are not met
Bioaccumulation	There is no data for this product.
Mobility	Based on available data, the classification criteria are not met
Other adverse effects	No data available

Section 13: Disposal considerations

Disposal methods

Waste from residues/unused products	Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.
Contaminated packaging	Do not reuse empty containers.

See section 8 for more information

Section 14: Transport information

ADG	Not regulated
IATA	Not regulated

IMDG Not regulated

Transport in bulk according to Annex II of MARPOL and the IBC Code
No information available

Section 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
Classified as a scheduled poison according to the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
Poison Schedule Number 10

Australian Industrial Chemicals Introduction Scheme (AICIS)

Illicit Drug Precursors/Reagents
This product contains one or more substance(s) on the Illicit Drug Precursors/Reagents list. Verify requirements related to using, handling, and storing these substances.
Legend
Category 3 - Chemicals and apparatus that may be used in the illicit production of drugs. Purchases from this list should alert companies or organisations to seek further indicators of any suspicious orders or enquiries. No official reporting is required.

International Inventories

TSCA	All components listed on inventory or are exempt
AIIC	All components listed on inventory or are exempt
NZIoC	All components listed on inventory or are exempt

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
AIIC - Australian Inventory of Industrial Chemicals
NZIoC - New Zealand Inventory of Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Not applicable

Section 16: Any other relevant information

Revision date 30-Apr-2025

Reason for revision Update to Format

Key or legend to abbreviations and acronyms used in the safety data sheet

ADR - The European Agreement concerning the International Carriage of Dangerous Goods by Road
bw – body weight
CAS – Chemical Abstracts Service
CLP – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Classification, Labelling and Packaging of substances and mixtures
EN 149 - European standard on filtering halfmasks to protect against particles
FFP - Filtering Facepieces
h - hour
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LL50 – Lethal Loading 50%
d - day
Derived No Effect Level (DNEL)
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
IATA/ICAO - International Air Transport Association / International Civil Aviation Organization
IMDG/IMO - International Maritime Dangerous Goods / International Maritime Organization
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
REACH – REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
VOC – Volatile Organic Carbon
UN – United Nations
VLA-EC - short-time excursion limits [Spain valores límite ambientales para la exposición de corta duración]
vPvB – very Persistent and very Bioaccumulative
w/w - weight/weight
Water hazard class (WGK)
UN – United Nations
VOC – Volatile Organic Carbon
TWA - Time-Weighted Average
STEL – Short Term Exposure Limit

Legend Section 8: Exposure controls/personal protection

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	Sk*	Skin designation
+	Sensitisers		

Key literature references and sources for data used to compile the SDS

Acute Exposure Guideline Level(s) (AEGL(s))
European Chemicals Agency (ECHA) (ECHA_API)
European Chemicals Agency (ECHA) Committee for Risk Assessment (ECHA_RAC)
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
NIOSH (National Institute for Occupational Safety and Health)

Disclaimer

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information isobtained from various sources including the manufacturer and other third party sources. The information may not be validunder all conditions nor if this material is used in combination with other materials or in any process. Final determination ofsuitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

SentinelCem Pro

Revision date: 08-Oct-2024 **Revision Number:** 1

Section 1: Identification: Product identifier and chemical identity

Product identifier

Product Name SentinelCem Pro

Product Code(s) HM010550

Other means of identification

Pure substance/mixture Mixture

Recommended use of the chemical and restrictions on use

Recommended use Additive
Uses advised against Consumer use.

Details of manufacturer or importer

Halliburton Australia Pty. Ltd.
15 Marriott Road, Jandakot, WA 6164
Australia
ACN Number: 009 000 775
Telephone Number: + 61 (08) 6424 4800

For further information, please contact

fdunexchem@halliburton.com

Emergency telephone number

Australia Emergency Telephone Number + 61 1 800 686 951
Global Incident Response Access Code: 334305
Contract Number: 14012

Australian Poisons Information Centre 24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

Section 2: Hazard(s) identification

Statement of Hazardous Nature: Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

GHS Classification

Carcinogenicity	Category 1A

Label elements



Signal word
DANGER

Hazard statements
May cause cancer.

Precautionary Statements - Prevention
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Wear protective gloves/clothing and eye/face protection.
Precautionary Statements - Response
IF exposed or concerned: Get medical advice/attention.
Precautionary Statements - Storage
Store locked up.
Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant.

Other hazards which do not result in classification
No information available.

Section 3: Composition/information on ingredients

Chemical name	CAS No.	Weight-%
Crystalline silica, quartz	14808-60-7	0.1 - 1%
Non-hazardous ingredients	Proprietary	Balance

Section 4: First aid measures

Description of first aid measures

General advice IF exposed or concerned: Get medical advice/attention.

Inhalation Remove to fresh air.

Eye contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a doctor.

Skin contact Wash skin with soap and water.

Ingestion Rinse mouth.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Effects of Exposure May cause cancer.

Indication of any immediate medical attention and special treatment needed

Note to doctors Treat symptomatically.

Section 5: Firefighting measures

Suitable Extinguishing Media

Suitable extinguishing media	Water fog, carbon dioxide, foam, dry chemical.
Large Fire	CAUTION: Use of water spray when fighting fire may be inefficient.
Unsuitable extinguishing media	Do not scatter spilled material with high pressure water streams.

Specific hazards arising from the chemical

Specific hazards arising from the chemical	No information available. Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

Special protective actions for fire-fighters

Special protective equipment and precautions for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions	Ensure adequate ventilation.
Other information	Refer to protective measures listed in Sections 7 and 8.
For emergency responders	Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions	See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so.

Precautions to prevent secondary hazards

Prevention of secondary hazards	Clean contaminated objects and areas thoroughly observing environmental regulations.

Section 7: Handling and storage, including how the chemical may be safely used

Precautions for safe handling

Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing.
General hygiene considerations	Do not eat, drink or smoke when using this product. Wash hands before breaks and immediately after handling the product.

Conditions for safe storage, including any incompatibilities

Storage Conditions	Store in a well ventilated area.
Incompatible materials	Strong oxidizers. Strong acids. Strong alkalis.

Section 8: Exposure controls and personal protection

Control parameters

Exposure Limits

Chemical name	Australia	New Zealand	ACGIH TLV
Crystalline silica, quartz 14808-60-7	TWA: 0.05 mg/m³	TWA: 0.025 mg/m³	-

Chemical name	OSHA PEL	NIOSH
Crystalline silica, quartz 14808-60-7	TWA: 50 µg/m³ (vacated) TWA: 0.1 mg/m³ respirable dust : (250)/(%SiO2 + 5) mppcf TWA respirable fraction : (10)/(%SiO2 + 2) mg/m³ TWA respirable fraction	IDLH: 50 mg/m³ respirable dust TWA: 0.05 mg/m³ respirable dust

Biological occupational exposure limits This product, as supplied, does not contain any hazardous materials with biological limits established by the region specific regulatory bodies

Appropriate engineering controls

Engineering controls Ensure adequate ventilation, especially in confined areas.

Individual protection measures, such as personal protective equipment

Eye/face protection No special protective equipment required.

Skin and body protection Wear suitable protective clothing.

Hand protection Wear suitable gloves.

Respiratory protection If engineering controls and work practices cannot keep exposure below occupational exposure limits or if exposure is unknown, wear a NIOSH certified, European Standard EN 149, AS/NZS 1715:2009, or equivalent respirator when using this product. Selection of and instruction on using all personal protective equipment, including respirators, should be performed by an Industrial Hygienist or other qualified professional.

Environmental exposure controls No information available.

Other protective equipment Eyewash fountains and safety showers must be easily accessible.

Thermal hazards No information available.

Section 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state Solid
Appearance No information available
Colour Various
Odour No information available.
Odour threshold No information available

Property	Values	Remarks • Method
pH		None known
Melting point / freezing point	No data available	
Initial boiling point and boiling range		
Flash point	No data available	None known
Evaporation rate	No data available	
Flammability	No data available	
Flammability Limit in Air		
Upper flammability or explosive	No data available	

limits	
Lower flammability or explosive limits	No data available
Vapour pressure	No data available
Relative vapour density	No data available
Relative density	No data available
Water solubility	No data available
Solubility(ies)	No data available
Partition coefficient	No data available
Autoignition temperature	No data available
Decomposition temperature	
Kinematic viscosity	No data available
Dynamic viscosity	No data available
Other information	
Pour Point	No data available
VOC content	No information available
Particle characteristics	No information available

Section 10: Stability and reactivity

Reactivity

Reactivity No information available.

Chemical stability

Stability Stable under normal conditions.

Explosion data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid None known based on information supplied.

Incompatible materials

Incompatible materials Strong oxidizers. Strong acids. Strong alkalis.

Hazardous decomposition products

Hazardous decomposition products Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

Section 11: Toxicological information

Information on likely routes of exposure

Principle Routes of Exposure Ingestion, Skin contact, Eye contact, Inhalation

Product Information

Inhalation Specific test data for the substance or mixture is not available.

Eye contact Specific test data for the substance or mixture is not available.

Skin contact Specific test data for the substance or mixture is not available.

Ingestion Specific test data for the substance or mixture is not available.

Symptoms No information available.

Acute toxicity .

Numerical measures of toxicity - Product Information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	99,999.00	mg/kg
ATEmix (dermal)	99,999.00	mg/kg
ATEmix (inhalation-gas)	99,999.00	ppm
ATEmix (inhalation-vapour)	99,999.00	mg/l
ATEmix (inhalation-dust/mist)	99,999.00	mg/l

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Crystalline silica, quartz	> 15000 mg/kg (human)	-	-

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation

Chemical name	**Skin corrosion/irritation**
Crystalline silica, quartz 14808-60-7	Non-irritating to the skin

Serious eye damage/eye irritation

Chemical name	**Serious eye damage/eye irritation**
Crystalline silica, quartz 14808-60-7	Non-irritating to the eye

Respiratory or skin sensitisation

Chemical name	Respiratory sensitisation
Crystalline silica, quartz 14808-60-7	Not classified
Chemical name	**Skin sensitisation**
Crystalline silica, quartz 14808-60-7	Not classified

Germ cell mutagenicity

Chemical name	**Germ cell mutagenicity**
Crystalline silica, quartz 14808-60-7	Not regarded as mutagenic.

Carcinogenicity Contains a known or suspected carcinogen. Classification based on data available for ingredients. May cause cancer.

Chemical name	**Carcinogenicity**
Crystalline silica, quartz 14808-60-7	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure.

The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical name	Australia	European Union	IARC
Crystalline silica, quartz - 14808-60-7	Carc. 1A	-	Group 1

Legend

IARC (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans

Reproductive toxicity

Chemical name	Reproductive toxicity
Crystalline silica, quartz 14808-60-7	This product does not contain any known or suspected reproductive hazards

STOT - single exposure

Chemical name	STOT - single exposure
Crystalline silica, quartz 14808-60-7	No significant toxicity observed in animal studies at concentration requiring classification.

STOT - repeated exposure

Chemical name	STOT - repeated exposure
Crystalline silica, quartz 14808-60-7	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)

Aspiration hazard

Chemical name	Aspiration hazard
Crystalline silica, quartz 14808-60-7	Based on available data, the classification criteria are not met

Section 12: Ecological information

Ecotoxicity

Aquatic ecotoxicity

Unknown aquatic toxicity 0 % of the mixture consists of component(s) of unknown hazards to the aquatic environment.

Chemical name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Crystalline silica, quartz	EC50(72 h)=440 mg/L (Pseudokirchneriella subcapitata)	LL0(96 h)=10000 mg/L (Danio rerio)	-	LL50(24 h)>10000 mg/L (Daphnia magna)

Terrestrial ecotoxicity There is no data for this product.

Persistence and degradability

Chemical name	Persistence and degradability
Crystalline silica, quartz 14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.

Bioaccumulation There is no data for this product.

Mobility Based on available data, the classification criteria are not met

Chemical name	Mobility
Crystalline silica, quartz 14808-60-7	No information available

Other adverse effects No data available

Section 13: Disposal considerations

Disposal methods

Waste from residues/unused products Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.

Contaminated packaging Do not reuse empty containers.

See section 8 for more information

Section 14: Transport information

ADG Not regulated

IATA Not regulated

IMDG Not regulated

Transport in bulk according to Annex II of MARPOL and the IBC Code
No information available

Section 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
No poisons schedule number allocated

Australian Industrial Chemicals Introduction Scheme (AICIS)

Chemical name	Australian Industrial Chemicals Introduction Scheme (AICIS)	Additional information	Crystalline silica, quartz - 14808-60-7
Contact supplier for inventory compliance status	-		

Illicit Drug Precursors/Reagents

This product does not contain any substance(s) on the Illicit Drug Precursors/Reagents list.

International Inventories

TSCA	All components listed on inventory or are exempt
AIIC	Product contains one or more components not listed on inventory
NZIoC	Product contains one or more components not listed on inventory

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
AIIC - Australian Inventory of Industrial Chemicals
NZIoC - New Zealand Inventory of Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Not applicable

Section 16: Any other relevant information

Revision date 08-Oct-2024

Reason for revision Initial Release

Key or legend to abbreviations and acronyms used in the safety data sheet

ADR - The European Agreement concerning the International Carriage of Dangerous Goods by Road
bw – body weight
CAS – Chemical Abstracts Service
CLP – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Classification, Labelling and Packaging of substances and mixtures
EN 149 - European standard on filtering halfmasks to protect against particles
FFP - Filtering Facepieces
h - hour
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LL50 – Lethal Loading 50%
d - day
Derived No Effect Level (DNEL)
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
IATA/ICAO - International Air Transport Association / International Civil Aviation Organization
IMDG/IMO - International Maritime Dangerous Goods / International Maritime Organization
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
REACH – REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
VOC – Volatile Organic Carbon

UN – United Nations
VLA-EC - short-time excursion limits [Spain valores límite ambientales para la exposición de corta duración]
vPvB – very Persistent and very Bioaccumulative
w/w - weight/weight
Water hazard class (WGK)
UN – United Nations
VOC – Volatile Organic Carbon
TWA - Time-Weighted Average
STEL – Short Term Exposure Limit

Legend Section 8: Exposure controls/personal protection

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	Sk*	Skin designation
+	Sensitisers		

Key literature references and sources for data used to compile the SDS

Acute Exposure Guideline Level(s) (AEGL(s))
European Chemicals Agency (ECHA) (ECHA_API)
European Chemicals Agency (ECHA) Committee for Risk Assessment (ECHA_RAC)
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
NIOSH (National Institute for Occupational Safety and Health)

Disclaimer

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information isobtained from various sources including the manufacturer and other third party sources. The information may not be validunder all conditions nor if this material is used in combination with other materials or in any process. Final determination ofsuitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

LATEX 4000

Revision date: 30-Mar-2026 **Revision Number:** 6

Section 1: Identification: Product identifier and chemical identity

Product identifier

Product Name LATEX 4000

Product Code(s) HM008963

Other means of identification

Pure substance/mixture Mixture

Recommended use of the chemical and restrictions on use

Recommended use Additive
Uses advised against No information available.

Details of manufacturer or importer

Halliburton Australia Pty. Ltd.
15 Marriott Road, Jandakot, WA 6164
Australia
ACN Number: 009 000 775
Telephone Number: + 61 (08) 6424 4800

For further information, please contact

fdunexchem@halliburton.com

Emergency telephone number

Australia Emergency Telephone Number + 61 1 800 686 951
Global Incident Response Access Code: 334305
Contract Number: 14012

Australian Poisons Information Centre 24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

Section 2: Hazard(s) identification

GHS Classification

Not a hazardous substance or mixture according to the Globally Harmonised System (GHS). Not classified.

Label elements

Hazard statements

Not a hazardous substance or mixture according to the Globally Harmonised System (GHS). Not classified.
Corrosive to the respiratory tract

Other hazards which do not result in classification

No information available.

Section 3: Composition/information on ingredients

The product contains no substances which at their given concentration, are considered to be hazardous to health

Non-hazardous ingredients	Proprietary	Balance

Section 4: First aid measures

Description of first aid measures

Inhalation Remove to fresh air.

Eye contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a doctor.

Skin contact Wash skin with soap and water.

Ingestion Rinse mouth.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Effects of Exposure No information available.

Indication of any immediate medical attention and special treatment needed

Note to doctors Treat symptomatically.

Section 5: Firefighting measures

Suitable Extinguishing Media

Suitable extinguishing media All standard fire fighting media.

Large Fire CAUTION: Use of water spray when fighting fire may be inefficient.

Unsuitable extinguishing media Do not scatter spilled material with high pressure water streams.

Specific hazards arising from the chemical

Specific hazards arising from the chemical No information available.

Thermal decomposition can lead to release of toxic/corrosive gases and vapours

Special protective actions for fire-fighters

Special protective equipment and precautions for fire-fighters Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protective equipment.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions	Ensure adequate ventilation.
For emergency responders	Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions	See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so.
Methods for cleaning up	Dam up. Soak up with inert absorbent material. Pick up and transfer to properly labelled containers. Clean contaminated surface thoroughly.

Precautions to prevent secondary hazards

Prevention of secondary hazards	Clean contaminated objects and areas thoroughly observing environmental regulations.

Section 7: Handling and storage, including how the chemical may be safely used

Precautions for safe handling

Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Conditions	Keep from freezing. Keep container tightly closed in a dry and well-ventilated place.
Incompatible materials	Strong oxidizers. Strong acids. Strong alkalis.

Section 8: Exposure controls and personal protection

Control Parameters

Exposure Limits

Biological occupational exposure limits	This product, as supplied, does not contain any hazardous materials with biological limits established by the region specific regulatory bodies

Appropriate engineering controls

Engineering controls	Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

Individual protection measures, such as personal protective equipment

Eye/face protection	Safety glasses with side-shields. If splashes are likely to occur, wear: Goggles, Face-shield. (EN-166).
Skin and body protection	Wear protective clothing appropriate for the work environment.
Hand protection	Use gloves which are suitable for the chemicals present in this product as well as other environmental factors in the workplace.
Respiratory protection	If engineering controls and work practices cannot keep exposure below occupational exposure limits or if exposure is unknown, wear a NIOSH certified, European Standard EN 149, AS/NZS 1715:2009, or equivalent respirator when using this product. Selection of and

instruction on using all personal protective equipment, including respirators, should be performed by an Industrial Hygienist or other qualified professional. Dust/mist respirator. (N95, P2/P3).

Environmental exposure controls No information available.

Other protective equipment Eyewash fountains and safety showers must be easily accessible.

Thermal hazards No information available.

Section 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state	Liquid
Appearance	No information available
Colour	Milky white
Odour	Faint.
Odour threshold	No information available

Property	**Values**	**Remarks • Method**
pH	6.5-7.5	
Melting point / freezing point	0 °C / 32 °F	
Initial boiling point and boiling range	100 °C / 212 °F	
Flash point	No data available	
Evaporation rate	No data available	
Flammability	No data available	
Flammability Limit in Air		
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapour pressure	No data available	
Relative vapour density	No data available	
Relative density	1.02	
Water solubility	Soluble in water	
Solubility(ies)	No data available	
Partition coefficient	No data available	
Autoignition temperature	No data available	
Decomposition temperature		
Kinematic viscosity	No data available	
Dynamic viscosity	No data available	
Other information		
Pour Point	No data available	
VOC content	.?	
Particle characteristics	No information available	

Section 10: Stability and reactivity

Reactivity

Reactivity No information available.

Chemical stability

Stability Stable under normal conditions.

Explosion data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid None known based on information supplied.

Incompatible materials

Incompatible materials Strong oxidizers. Strong acids. Strong alkalis.

Hazardous decomposition products

Hazardous decomposition products Thermal decomposition can lead to release of toxic/corrosive gases and vapours.

Section 11: Toxicological information

Information on likely routes of exposure

Principle Routes of Exposure Ingestion, Skin contact, Eye contact, Inhalation

Product Information

Inhalation	Specific test data for the substance or mixture is not available.
Eye contact	Specific test data for the substance or mixture is not available.
Skin contact	Specific test data for the substance or mixture is not available.
Ingestion	Specific test data for the substance or mixture is not available.

Symptoms No information available.

Acute toxicity .

Numerical measures of toxicity - Product Information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	99,999.00 mg/kg
ATEmix (dermal)	99,999.00 mg/kg
ATEmix (inhalation-gas)	99,999.00 ppm
ATEmix (inhalation-vapour)	99,999.000 mg/L
ATEmix (inhalation-dust/mist)	99,999.0000 mg/L

Component Information

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation No information available.

Serious eye damage/eye irritation No information available.

Respiratory or skin sensitisation No information available.

Germ cell mutagenicity No information available.

Carcinogenicity	No information available.
Reproductive toxicity	No information available.
STOT - single exposure	No information available.
STOT - repeated exposure	No information available.
Aspiration hazard	No information available.

Section 12: Ecological information

Ecotoxicity	Based on available data, the classification criteria are not met
Terrestrial ecotoxicity	There is no data for this product.
Persistence and degradability	No information available
Bioaccumulation	No information available.
Mobility	No information available
Other adverse effects	No data available

Section 13: Disposal considerations

Disposal methods

Waste from residues/unused products	Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.
Contaminated packaging	Do not reuse empty containers.

See section 8 for more information

Section 14: Transport information

ADG	Not regulated
IATA	Not regulated
IMDG	Not regulated

Transport in bulk according to Annex II of MARPOL and the IBC Code
No information available

Section 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
Classified as a scheduled poison according to the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
Poison Schedule Number 6

Australian Industrial Chemicals Introduction Scheme (AICIS)

Illicit Drug Precursors/Reagents
This product does not contain any substance(s) on the Illicit Drug Precursors/Reagents list.

International Inventories

TSCA	All components listed on inventory or are exempt
AIIC	All components listed on inventory or are exempt
NZIoC	All components listed on inventory or are exempt

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
AIIC - Australian Inventory of Industrial Chemicals
NZIoC - New Zealand Inventory of Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Not applicable

Section 16: Any other relevant information

Revision date 30-Mar-2026

Reason for revision Update to Format

Key or legend to abbreviations and acronyms used in the safety data sheet
ADR - The European Agreement concerning the International Carriage of Dangerous Goods by Road
bw – body weight
CAS – Chemical Abstracts Service
CLP – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Classification, Labelling and Packaging of substances and mixtures

EN 149 - European standard on filtering halfmasks to protect against particles
FFP - Filtering Facepieces
h - hour
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LL50 – Lethal Loading 50%
d - day
Derived No Effect Level (DNEL)
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
IATA/ICAO - International Air Transport Association / International Civil Aviation Organization
IMDG/IMO - International Maritime Dangerous Goods / International Maritime Organization
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
REACH – REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
VOC – Volatile Organic Carbon
UN – United Nations
VLA-EC - short-time excursion limits [Spain valores límite ambientales para la exposición de corta duración]
vPvB – very Persistent and very Bioaccumulative
w/w - weight/weight
Water hazard class (WGK)
UN – United Nations
VOC – Volatile Organic Carbon
TWA - Time-Weighted Average
STEL – Short Term Exposure Limit

Legend Section 8: Exposure controls/personal protection

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	Sk*	Skin designation
+	Sensitisers		

Key literature references and sources for data used to compile the SDS

Acute Exposure Guideline Level(s) (AEGL(s))
European Chemicals Agency (ECHA) (ECHA_API)
European Chemicals Agency (ECHA) Committee for Risk Assessment (ECHA_RAC)
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
NIOSH (National Institute for Occupational Safety and Health)

Disclaimer

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information isobtained from various sources including the manufacturer and other third party sources. The information may not be validunder all conditions nor if this material is used in combination with other materials or in any process. Final determination ofsuitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

MICROBOND HT CEMENT

Revision date: 07-Aug-2024 **Revision Number:** 36

Section 1: Identification: Product identifier and chemical identity

Product identifier

Product Name MICROBOND HT CEMENT

Product Code(s) HM001065

Other means of identification

Pure substance/mixture Substance

Recommended use of the chemical and restrictions on use

Recommended use Cement Additive
Uses advised against No information available.

Details of manufacturer or importer

Halliburton Australia Pty. Ltd.
15 Marriott Road, Jandakot, WA 6164
Australia
ACN Number: 009 000 775
Telephone Number: + 61 (08) 6424 4800

For further information, please contact

fdunexchem@halliburton.com

Emergency telephone number

Australia Emergency Telephone Number + 61 1 800 686 951
Global Incident Response Access Code: 334305
Contract Number: 14012

Australian Poisons Information Centre 24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

Section 2: Hazard(s) identification

Statement of Hazardous Nature: Non-Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

GHS Classification

Not a hazardous substance or mixture according to the Globally Harmonised System (GHS). Not classified.

Label elements

Hazard statements

Not a hazardous substance or mixture according to the Globally Harmonised System (GHS). Not classified.

Other hazards which do not result in classification

No information available.

Section 3: Composition/information on ingredients

The product contains no substances which at their given concentration, are considered to be hazardous to health

Section 4: First aid measures

Description of first aid measures

Inhalation	Remove to fresh air.
Eye contact	Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a doctor.
Skin contact	Wash skin with soap and water.
Ingestion	Rinse mouth.

Most important symptoms and effects, both acute and delayed

Symptoms	No information available.
Effects of Exposure	No information available.

Indication of any immediate medical attention and special treatment needed

Note to doctors	Treat symptomatically.

Section 5: Firefighting measures

Suitable Extinguishing Media

Suitable extinguishing media	All standard fire fighting media. Water fog, carbon dioxide, foam, dry chemical.
Large Fire	CAUTION: Use of water spray when fighting fire may be inefficient.
Unsuitable extinguishing media	Do not scatter spilled material with high pressure water streams.

Specific hazards arising from the chemical

Specific hazards arising from the chemical	No information available.
Hazardous combustion products	None. None known.

Special protective actions for fire-fighters

Special protective equipment and precautions for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions	Ensure adequate ventilation.
For emergency responders	Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions	See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so.

Precautions to prevent secondary hazards

Prevention of secondary hazards	Clean contaminated objects and areas thoroughly observing environmental regulations.

Section 7: Handling and storage, including how the chemical may be safely used

Precautions for safe handling

Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Conditions	Store in a cool, dry location. Store in a cool well ventilated area. Product has a shelf life of 36 months.
Incompatible materials	None known.

Section 8: Exposure controls and personal protection

Control parameters

Exposure Limits

Biological occupational exposure limits	This product, as supplied, does not contain any hazardous materials with biological limits established by the region specific regulatory bodies

Appropriate engineering controls

Engineering controls	Use in a well ventilated area.

Individual protection measures, such as personal protective equipment

Eye/face protection	Wear safety glasses or goggles to protect against exposure. (EN-166).
Skin and body protection	Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing. Normal work coveralls.
Hand protection	Suitable materials for longer, direct contact (recommended: protection index 6, corresponding to > 480 minutes permeation time as per EN 374):. Normal work gloves.
Respiratory protection	Not normally needed. But if significant exposures are possible then the following respirator is recommended:

Dust/mist respirator. (N95, P2/P3).

Environmental exposure controls No information available.

Other protective equipment Eyewash fountains and safety showers must be easily accessible.

Thermal hazards No information available.

Section 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state	Solid
Appearance	No information available
Colour	White to Light grey
Odour	Odourless.
Odour threshold	No information available

Property	**Values**	**Remarks • Method**
pH	10.5	None known
Melting point / freezing point	No data available	
Initial boiling point and boiling range		
Flash point	No data available	None known
Evaporation rate	No data available	
Flammability	No data available	
Flammability Limit in Air		
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapour pressure	No data available	
Relative vapour density	No data available	
Relative density	3.46	
Water solubility	Insoluble in water	
Solubility(ies)	No data available	
Partition coefficient	No data available	
Autoignition temperature	No data available	
Decomposition temperature		
Kinematic viscosity	No data available	
Dynamic viscosity	No data available	
Other information		
Pour Point	No data available	
VOC content	.?	
Bulk density	100 lbs/ft3	
Particle characteristics	No information available	

Section 10: Stability and reactivity

Reactivity

Reactivity No information available.

Chemical stability

Stability Stable under normal conditions.

Explosion data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid None known based on information supplied.

Incompatible materials

Incompatible materials None known.

Hazardous decomposition products

Hazardous decomposition products None known.

Section 11: Toxicological information

Information on likely routes of exposure

Principle Routes of Exposure Ingestion, Skin contact, Eye contact, Inhalation

Product Information

Inhalation	Specific test data for the substance or mixture is not available.
Eye contact	Specific test data for the substance or mixture is not available.
Skin contact	Specific test data for the substance or mixture is not available.
Ingestion	Specific test data for the substance or mixture is not available.

Symptoms No information available.

Acute toxicity .

Numerical measures of toxicity - Product Information

Component Information
See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation

Serious eye damage/eye irritation

Respiratory or skin sensitisation

Germ cell mutagenicity

Carcinogenicity

Reproductive toxicity

STOT - single exposure

STOT - repeated exposure

Aspiration hazard

Section 12: Ecological information

Ecotoxicity

Aquatic ecotoxicity The environmental impact of this product has not been fully investigated.

Terrestrial ecotoxicity There is no data for this product.

Persistence and degradability

Bioaccumulation There is no data for this product.

Mobility

Other adverse effects

Section 13: Disposal considerations

Disposal methods

Waste from residues/unused products Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.

Contaminated packaging Do not reuse empty containers.

See section 8 for more information

Section 14: Transport information

ADG Not regulated

IATA Not regulated

IMDG Not regulated

Transport in bulk according to Annex II of MARPOL and the IBC Code
No information available

Special precautions for user
Not regulated

Section 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
No poisons schedule number allocated

Australian Industrial Chemicals Introduction Scheme (AICIS)

Illicit Drug Precursors/Reagents
This product does not contain any substance(s) on the Illicit Drug Precursors/Reagents list.

National pollutant inventory
Subject to reporting requirement

International Inventories

TSCA	All components listed on inventory or are exempt
AIIC	All components listed on inventory or are exempt
NZIoC	All components listed on inventory or are exempt

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
AIIC - Australian Inventory of Industrial Chemicals
NZIoC - New Zealand Inventory of Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Not applicable

Section 16: Any other relevant information

Revision date	07-Aug-2024
Reason for revision	Update to Format

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VLA-EC - short-time excursion limits [Spain valores límite ambientales para la exposición de corta duración]
vPvB – very Persistent and very Bioaccumulative
w/w - weight/weight
Water hazard class (WGK)
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TWA - Time-Weighted Average
STEL – Short Term Exposure Limit

Legend Section 8: Exposure controls/personal protection

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	Sk*	Skin designation
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Hazardous Substance Database
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NIOSH (National Institute for Occupational Safety and Health)

Disclaimer

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End of Safety Data Sheet

SAFETY DATA SHEET

OVA TRICIDE 70

Section 1. Identification

Product identifier	:	OVA TRICIDE 70
Product code	:	OVA TRICIDE 70
ADG	:	AMINES, LIQUID, CORROSIVE, N.O.S. (contains triazine)
Product type	:	Liquid
Identified uses	:	Biocide
Importer's details	:	Baker Hughes, Australia 631 Karel Avenue, Jandakot, Western Australia 6164, Australia Tel: 08 6595 7100
Manufacturer's details	:	OVA CHEM SDN. BHD. A Barium Selat Company No 6-1, Jalan Tasik Utama 7, Medan Niaga Tasik Damai, 57000 Sungai Besi, Kuala Lumpur. Tel/Fax: +603 9054 1203
Emergency telephone number	:	CHEMTREC Emergency Telephone Numbers (Asia Pacific Region): - Australia: (02) 9037 2994 - Brunei: +(65)-31581349 (Mandarin/English) - China: 4001-204937 (Mandarin) * - Hong Kong: 800-968-793 (Cantonese) * - Indonesia: 001-803-017-9114 (Bahasa Indonesian) * - Japan: +(81)-345209637 (Japanese) - Malaysia: 1-800-815-308 (Bahasa Malay) * - New Zealand: 09 801 0034 - Philippines: 1-800-1-116-1020 (Tagalog) * - PNG: +(61) 2 9037 2994 - Singapore: 800-101-2201 (Mandarin) * - South Korea: 00-308-13-2549 (Korean) * - Taiwan: 00801-14-8954 (Mandarin) * - Thailand: 001-800-13-203-9987 (Thai) * - Vietnam: +(84)-838012436 (Vietnamese) - UK: +(44) 870-820-0418 - USA: +(1) 703-527-3887 (CHEMTREC International 24 hour) * Number can only be dialled in-country
Date	:	20 May 2024

This is a Baker Hughes cover page for our Supplier's SDS. A copy of this SDS has been provided to CHEMTREC
Baker Hughes Confidential

OVACHEM
Tomorrow's Chemistry Today
a Barium Selat Company

Safety Data Sheet
OVA TRICIDE 70%

Section 1: Chemical Product and Company Identification

Product Name: OVA TRICIDE 70

CAS#: Not available.

RTECS: Not available.

TSCA: Not available.

CI#: Not available.

Synonym: Biocide

Chemical Name: Triazine based

Chemical Formula: Not available

Contact Information:

OVA CHEM SDN. BHD.
No 6, Jalan Tasik Utama 7
Medan Niaga Tasik Damai
57000 Sungai Besi, Kuala Lumpur.
Tel/Fax: +603 9054 1203

For emergency assistance, call: +6012 368 3559

Section 2: Composition and Information on Ingredients

Composition: Mixture

Name	CAS #	% by Weight
Triazine	Various	70-80
Water	7732-18-5	20-30

Section 3: Hazards Identification

Health Hazard: H304-May be fatal if swallowed

H315-Causes skin irritation

H319-Causes serious eye irritation

H336-May cause dizziness

Physical Hazard: No data available



Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact:

Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used.

Inhalation:

Remove source of contamination or move victim to fresh air. Apply artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult. Get immediate medical attention.

Ingestion:

If burn is present, treat as any thermal burn, after decontamination. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient. No specific antidote. Due to irritant properties, swallowing may result in burns/ulceration of mouth, stomach and lower gastrointestinal tract with subsequent stricture. Aspiration of vomitus may cause lung injury. Suggest endotracheal/esophageal control if lavage is done.

Section 5: Fire and Explosion Data

Flash Point: > 150 ˚C

Auto Ignition Temperature: > 250˚C

General Information As in any fire, wear a self-contained breathing apparatus in pressure demand, MSHA/NIOSH (approved or equivalent), and full protective gear.

Suitable Extinguishing Media
Water fog or fine spray. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam. Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective.

Extinguish media, which shall not be used for safety reasons
Do not use direct water stream. May spread fire

Special exposure hazards in a fire:
During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. Combustion products may include and are not limited to: Carbon monoxide. Carbon dioxide. Container may rupture from gas generation in a fire situation. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids.

Special protective equipment for fire fighters:
Keep people away. Isolate fire and deny unnecessary entry. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed. Fight fire from protected location or safe distance. Consider the use of unmanned hose holders or monitor nozzles. Immediately withdraw all personnel from the area in case of rising sound from venting safety device or discoloration of the container. Burning liquids may be extinguished by dilution with water. Do not use direct water stream. May spread fire. Move container from fire area if this is possible without hazard. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage.

Other instructions: On leakage it becomes slippery

Section 6: Accidental Release Measures

Personal Precautions: Wear protective clothing as described in Section 8 of this safety data sheet.

Environmental Precautions: Do not allow to enter drains, sewers or watercourses.

Small Spill: Remove all ignition sources. Clean up all spills immediately. Avoid breathing vapours and contact with skin and eyes. Control personal contact with the substance, by using protective equipment. Contain and absorp spill with sand, earth, inert material or vermiculite.

Large Spill: Clear area of personnel and move upwind. Alert Fire Brigade and tell them location and nature of hazard. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or water course.

Section 7: Handling and Storage

Precautions: Do not ingest. Do not breathe vapours/spray. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Avoid reaction with oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Exposure limit values:
Not applicable
Exposure controls:
Occupational exposure controls:
Use in a well-ventilated area. Local exhaust ventilation should be used in areas without good cross ventilation.
Respiratory protection
On exposure wear a NIOSH certified. European Standard EN 149 or equivalent respirator when using this product.
Hand protection
Protective gloves (Europe EN374, US F739)
Eye protection
Safety goggles (European standard – EN 166)
Skin protection
Normal clothes
General protective measures
Avoid contact with skin and eyes, do not inhale vapour
Environmental exposure controls
Not any

Section 9: Physical and Chemical Properties

Physical state and appearance: Pale yellow liquid

Odor: Ammonical

pH (5%): >10.0

Flash Point: >150 ˚C

Boiling Point: >100˚C

Auto-Ignition Temperature: >250˚C

Specific Gravity : 1.15

Relative density: Not available.

Critical Temperature: Not available.

Vapor Pressure: Not applicable.

Volatility: Not available.

Odor Threshold: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Miscible in water

Section 10: Stability and Reactivity Data

Reactivity: Will not polymerize.

Chemical stability: Stable at typical use temperature (max 100 ˚C)

Materials to avoid: Avoid contact with: Strong acids, strong oxidizers.

Conditions to avoid: Do not distill to dryness. Product can oxidize at elevated temperatures.

Hazardous decomposition products: Decomposition products depend upon temperature, air supply and the presence of other materials. Toxic gases are released during decomposition. Emits carbon oxides and nitrogen oxides when heated to decomposition.

Section 11: Toxicological Information

Acute Toxicity

Inhalation

Harmful if inhaled. May cause respiratory irritation. May cause central nervous system depression including headache, dizziness, drowsiness, incoordination, slowed reaction time, slurred speech, giddiness and unconsciousness.
LD50 (oral,rat) = 2,900 mg/kg
LD50 (dermal, rabbit) = 1,840 mg/kg

Eye Contact

Causes serious eye damage

Skin Contact: Causes skin irritation. May be absorbed through the skin and contribute to the symptoms listed under ingestion.

Ingestion: Low toxicity if swallowed. Small amounts swallowed incidentally as a result of normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury. Swallowing may result in gastrointestinal irritation or ulceration.

Chronic Effects/Carcinogenicity: No component of this product present at level greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen.

Section 12: Ecological Information

Ecotoxicity and aquatoxicity:
Acute for fish:
Poecilia reticulata: LC50 (96 h) > 100 mg/l
Longterm for fish: NOEC > 100 mg/l
Acute for invertebrates: Daphnia magna: EC50 (48 h) = 62.6 mg/l Longterm for invertebrates: no data available
Effective concentration for algae: EC50 (72 h) > 77.7 mg/l
Algae: ErC10 (72 h) = 0.4 mg/l
Summary for classification: Not classified

Biodegradibility: Biodegradable

Mobility: Potential for mobility in soil is very high (Koc between 0 and 50)

Bioaccumulative potential: BCF < 50

Other adverse effects: This substance is not on the Montreal Protocol list of substances that deplete the ozone layer.

Section 13: Disposal Considerations

Disposal Method
Disposal should be made in accordance with federal, state, and local regulations. Incineration recommended in approved incinerator according to federal, state, and local regulations. Substance should not be deposited into a sewage facility.

Packaging Disposal
Follow all applicable national or local regulations. Contaminated packaging may be disposed of by rendering packaging incapable of containing any substance, or treating packaging to remove residual contents, or treating packaging to make sure the residual contents are no longer hazardous, or by disposing of packaging into commercial waste collection.

Regulatory Disposal Information
RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrositivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning
Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAYEXPLODE AND CAUSE INJURY OR DEATH.

Section 14: Transport Information

IMDG/IMO	: Corrosive Liquid
UN Number	: 2735
UN Proper Shipping Name	: Amines, Liquid, Corrosive
Transport Hazard Class(es)	: 8
Packing Group	: III
Environmental Hazard	: Not applicable
NZ 5433.1999	: Corrosive Liquid
UN Number	: 2735
UN Proper Shipping Name	: Amines, Liquid, Corrosive
Transport Hazard Class(es)	: 8
Packing Group	: III
IATA/ICAO	: Corrosive Liquid
UN Number	: 2735
UN Proper Shipping Name	: Amines, Liquid, Corrosive
Transport Hazard Class(es)	: 8
Packing Group	: III
Special Precautions for User	: Not applicable
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	: Not applicable

Section 15: Regulatory Information

Other Label Information :

EU regulations concerning safety, health and environmental specific for the substance or mixture, as amended:

Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006;

Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC; Directive

2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives; Council Directive 96/82/EC on the control of major-accident hazards involving dangerous substances.

Legislation and regulations :

Dangerous Substance Directive 67/548/EEC. The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 (S.I 2009 No. 716). The List of Wastes (England) (Amendment) Regulations 2005. (SI 2005 No.895). Avfallsförordningen (2011:927).

Section 16: Other Information

Other Special Considerations: Not available.

Last Updated: 19/06/2023

GENERAL INFORMATION	
HMIS HEALTH	2
HMIS Flammability	1
HMIS Physical Hazard	0



The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall OVA Chem be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if OVA Chem has been advised of the possibility of such damage.

HALLIBURTON

SAFETY DATA SHEET

SA-1015

Revision date: 30-Mar-2026 **Revision Number:** 26

Section 1: Identification: Product identifier and chemical identity

Product identifier

Product Name SA-1015

Product Code(s) HM007221

Other means of identification

CAS No. 125005-87-0

Pure substance/mixture Substance

Recommended use of the chemical and restrictions on use

Recommended use Suspending Agent
Uses advised against No information available.

Details of manufacturer or importer

Halliburton Australia Pty. Ltd.
15 Marriott Road, Jandakot, WA 6164
Australia
ACN Number: 009 000 775
Telephone Number: + 61 (08) 6424 4800

For further information, please contact

fdunexchem@halliburton.com

Emergency telephone number

Australia Emergency Telephone Number + 61 1 800 686 951
Global Incident Response Access Code: 334305
Contract Number: 14012

Australian Poisons Information Centre 24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

Section 2: Hazard(s) identification

Statement of Hazardous Nature: Non-Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

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Hazard statements

Not a hazardous substance or mixture according to the Globally Harmonised System (GHS). Not classified.

Other hazards which do not result in classification
May form combustible dust concentrations in air.

Section 3: Composition/information on ingredients

The product contains no substances which at their given concentration, are considered to be hazardous to health

If CAS number is "proprietary", the specific chemical identity and percentage of composition has been withheld as a trade secret

Section 4: First aid measures

Description of first aid measures

Inhalation	Remove to fresh air.
Eye contact	Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a doctor.
Skin contact	Wash skin with soap and water.
Ingestion	Rinse mouth.

Most important symptoms and effects, both acute and delayed

Symptoms	Dust irritates eyes and air passages.
Effects of Exposure	No information available.

Indication of any immediate medical attention and special treatment needed

Note to doctors	Treat symptomatically.

Section 5: Firefighting measures

Suitable Extinguishing Media

Suitable extinguishing media	Water fog, carbon dioxide, foam, dry chemical.
Large Fire	CAUTION: Use of water spray when fighting fire may be inefficient.
Unsuitable extinguishing media	Do not scatter spilled material with high pressure water streams.

Specific hazards arising from the chemical

Specific hazards arising from the chemical	Avoid generation of dust. Carbon monoxide and carbon dioxide.

Special protective actions for fire-fighters

Special protective equipment and precautions for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protective equipment.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions	Use personal protective equipment as required. Ensure adequate ventilation. Avoid contact with eyes. Do not breathe dust.
Other information	Refer to protective measures listed in Sections 7 and 8.
For emergency responders	Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions	See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so. Prevent dust cloud. Cover powder spill with plastic sheet or tarp to minimise spreading. Do not touch or walk through spilled material.
Methods for cleaning up	Take up with inert, damp, non-combustible material using clean non-sparking tools and place into loosely covered plastic containers for later disposal. Pick up and transfer to properly labelled containers. Avoid generation of dust. Use personal protective equipment as required.

Precautions to prevent secondary hazards

Prevention of secondary hazards	Clean contaminated objects and areas thoroughly observing environmental regulations.

Section 7: Handling and storage, including how the chemical may be safely used

Precautions for safe handling

Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes. Avoid generation of dust. Do not breathe dust. Ensure adequate ventilation. Fine dust dispersed in air, in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.
General hygiene considerations	Do not breathe dust.

Conditions for safe storage, including any incompatibilities

Storage Conditions	Store in a dry location. Store away from oxidizers. Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Keep container closed when not in use. Keep containers tightly closed in a dry, cool and well-ventilated place. Store locked up. Keep out of the reach of children.
Incompatible materials	Strong oxidizers.

Section 8: Exposure controls and personal protection

Control Parameters

Exposure Limits	This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.
Biological occupational exposure limits	This product, as supplied, does not contain any hazardous materials with biological limits established by the region specific regulatory bodies

Appropriate engineering controls

Engineering controls Use in a well ventilated area.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses or goggles to protect against exposure. (EN-166). Wear safety glasses with side shields (or goggles).

Skin and body protection Wear impervious protective clothing, including boots, gloves, lab coat, apron, rain jacket, pants or coverall, as appropriate, to prevent skin contact.

Hand protection Use gloves which are suitable for the chemicals present in this product as well as other environmental factors in the workplace.

Respiratory protection If engineering controls and work practices cannot keep exposure below occupational exposure limits or if exposure is unknown, wear a NIOSH certified, European Standard EN 149, AS/NZS 1715:2009, or equivalent respirator when using this product. Selection of and instruction on using all personal protective equipment, including respirators, should be performed by an Industrial Hygienist or other qualified professional.

Environmental exposure controls No information available.

Other protective equipment Eyewash fountains and safety showers must be easily accessible.

Thermal hazards No information available.

Section 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state	Powder
Appearance	No information available
Colour	White to tan
Odour	Slight.
Odour threshold	No information available

Property	**Values**	**Remarks • Method**
pH	7 (1%)	
Melting point / freezing point	No data available	
Initial boiling point and boiling range		
Flash point	No data available	
Evaporation rate	No data available	
Flammability	No data available	
Flammability Limit in Air		
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapour pressure	No data available	
Relative vapour density	No data available	
Relative density	1.45 - 1.55	
Water solubility	Forms gel	
Solubility(ies)	No data available	
Partition coefficient	No data available	
Autoignition temperature	351 °C / 663.8 °F	
Decomposition temperature		
Kinematic viscosity	No data available	
Dynamic viscosity	No data available	
Other information		
Pour Point	No data available	
VOC content	No information available	

Particle characteristics No information available

Section 10: Stability and reactivity

Reactivity

Reactivity Combustible dust.

Chemical stability

Stability MAY FORM COMBUSTIBLE DUST- AIR MIXTURE.

Explosion data
Sensitivity to mechanical impact None.
Sensitivity to static discharge Yes.

Possibility of hazardous reactions

Possibility of hazardous reactions Dust can form an explosive mixture with air.

Conditions to avoid

Conditions to avoid Excessive heat. Heating in air. Generation/formation of dust.

Incompatible materials

Incompatible materials Strong oxidizers.

Hazardous decomposition products

Hazardous decomposition products Carbon monoxide and carbon dioxide.

Section 11: Toxicological information

Information on likely routes of exposure

Principle Routes of Exposure Ingestion, Skin contact, Eye contact, Inhalation

Product Information

Inhalation Specific test data for the substance or mixture is not available. May cause irritation of respiratory tract.

Eye contact Specific test data for the substance or mixture is not available.

Skin contact Specific test data for the substance or mixture is not available.

Ingestion Specific test data for the substance or mixture is not available.

Symptoms No information available.

Acute toxicity .

Numerical measures of toxicity - Product Information
No information available

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation	Based on available data, the classification criteria are not met.
Serious eye damage/eye irritation	Based on available data, the classification criteria are not met.
Respiratory or skin sensitisation	Based on available data, the classification criteria are not met.
Germ cell mutagenicity	Based on available data, the classification criteria are not met.
Carcinogenicity	Based on available data, the classification criteria are not met.
Reproductive toxicity	Based on available data, the classification criteria are not met.
STOT - single exposure	Based on available data, the classification criteria are not met.
STOT - repeated exposure	Based on available data, the classification criteria are not met.
Aspiration hazard	Based on available data, the classification criteria are not met.

Section 12: Ecological information

Ecotoxicity	Based on available data, the classification criteria are not met
Terrestrial ecotoxicity	There is no data for this product.
Persistence and degradability	Based on available data, the classification criteria are not met
Bioaccumulation	There is no data for this product.
Mobility	Based on available data, the classification criteria are not met
Other adverse effects	No data available

Section 13: Disposal considerations

Disposal methods

Waste from residues/unused products	Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.
Contaminated packaging	Do not reuse empty containers.

See section 8 for more information

Section 14: Transport information

ADG Not regulated

IATA Not regulated

IMDG Not regulated

Transport in bulk according to Annex II of MARPOL and the IBC Code
No information available

Section 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
No poisons schedule number allocated

Australian Industrial Chemicals Introduction Scheme (AICIS)

Illicit Drug Precursors/Reagents
This product does not contain any substance(s) on the Illicit Drug Precursors/Reagents list.

International Inventories

TSCA	All components listed on inventory or are exempt
AIIC	All components listed on inventory or are exempt
NZIoC	All components listed on inventory or are exempt

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
AIIC - Australian Inventory of Industrial Chemicals
NZIoC - New Zealand Inventory of Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Not applicable

Section 16: Any other relevant information

Revision date	30-Mar-2026
Reason for revision	Update to Format

Key or legend to abbreviations and acronyms used in the safety data sheet

ADR - The European Agreement concerning the International Carriage of Dangerous Goods by Road
bw – body weight
CAS – Chemical Abstracts Service
CLP – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Classification, Labelling and Packaging of substances and mixtures
EN 149 - European standard on filtering halfmasks to protect against particles
FFP - Filtering Facepieces
h - hour
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LL50 – Lethal Loading 50%
d - day
Derived No Effect Level (DNEL)
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
IATA/ICAO - International Air Transport Association / International Civil Aviation Organization
IMDG/IMO - International Maritime Dangerous Goods / International Maritime Organization
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
REACH – REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
VOC – Volatile Organic Carbon
UN – United Nations
VLA-EC - short-time excursion limits [Spain valores límite ambientales para la exposición de corta duración]
vPvB – very Persistent and very Bioaccumulative
w/w - weight/weight
Water hazard class (WGK)
UN – United Nations
VOC – Volatile Organic Carbon
TWA - Time-Weighted Average
STEL – Short Term Exposure Limit

Legend Section 8: Exposure controls/personal protection

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	Sk*	Skin designation
+	Sensitisers		

Key literature references and sources for data used to compile the SDS

Acute Exposure Guideline Level(s) (AEGL(s))
European Chemicals Agency (ECHA) (ECHA_API)
European Chemicals Agency (ECHA) Committee for Risk Assessment (ECHA_RAC)
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
NIOSH (National Institute for Occupational Safety and Health)

Disclaimer

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information isobtained from various sources including the manufacturer and other third party sources. The information may not be validunder all conditions nor if this material is used in combination with other materials or in any process. Final determination ofsuitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

SCR-100L

Revision date: 04-Oct-2024 **Revision Number:** 34

Section 1: Identification: Product identifier and chemical identity

Product identifier

Product Name SCR-100L

Product Code(s) HM001254

Other means of identification

Pure substance/mixture Mixture

Recommended use of the chemical and restrictions on use

Recommended use Retarder
Uses advised against No information available.

Details of manufacturer or importer

Halliburton Australia Pty. Ltd.
15 Marriott Road, Jandakot, WA 6164
Australia
ACN Number: 009 000 775
Telephone Number: + 61 (08) 6424 4800

For further information, please contact

fdunexchem@halliburton.com

Emergency telephone number

Australia Emergency Telephone Number + 61 1 800 686 951
Global Incident Response Access Code: 334305
Contract Number: 14012

Australian Poisons Information Centre 24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

Section 2: Hazard(s) identification

Statement of Hazardous Nature: Non-Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

GHS Classification

Not a hazardous substance or mixture according to the Globally Harmonised System (GHS). Not classified.

Label elements

Hazard statements

Not a hazardous substance or mixture according to the Globally Harmonised System (GHS). Not classified.

Other hazards which do not result in classification

No information available.

Section 3: Composition/information on ingredients

The product contains no substances which at their given concentration, are considered to be hazardous to health

Chemical name	CAS No.	Weight-%
Non-hazardous ingredients	Proprietary	Balance

Section 4: First aid measures

Description of first aid measures

Inhalation Remove to fresh air.

Eye contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a doctor.

Skin contact Wash skin with soap and water.

Ingestion Rinse mouth.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Effects of Exposure No information available.

Indication of any immediate medical attention and special treatment needed

Note to doctors Treat symptomatically.

Section 5: Firefighting measures

Suitable Extinguishing Media

Suitable extinguishing media All standard fire fighting media.

Large Fire CAUTION: Use of water spray when fighting fire may be inefficient.

Unsuitable extinguishing media Do not scatter spilled material with high pressure water streams.

Specific hazards arising from the chemical

Specific hazards arising from the chemical No information available.

Oxides of nitrogen. Oxides of sulfur. Carbon monoxide and carbon dioxide.

Special protective actions for fire-fighters

Special protective equipment and precautions for fire-fighters Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions	Ensure adequate ventilation.
For emergency responders	Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions	See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so.

Precautions to prevent secondary hazards

Prevention of secondary hazards	Clean contaminated objects and areas thoroughly observing environmental regulations.

Section 7: Handling and storage, including how the chemical may be safely used

Precautions for safe handling

Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Conditions	Store away from oxidizers. Store in a dry location. Keep container closed when not in use.
Incompatible materials	Strong oxidizers.

Section 8: Exposure controls and personal protection

Control parameters

Exposure Limits	This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.
Biological occupational exposure limits	This product, as supplied, does not contain any hazardous materials with biological limits established by the region specific regulatory bodies

Appropriate engineering controls

Engineering controls	Use in a well ventilated area.

Individual protection measures, such as personal protective equipment

Eye/face protection	Wear safety glasses or goggles to protect against exposure. (EN-166).
Skin and body protection	Normal work coveralls.
Hand protection	Normal work gloves.
Respiratory protection	Not normally needed. But if significant exposures are possible then the following respirator is recommended: Dust/mist respirator. (N95, P2/P3).

Environmental exposure controls No information available.

Other protective equipment Eyewash fountains and safety showers must be easily accessible.

Thermal hazards No information available.

Section 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state	Liquid
Appearance	No information available
Colour	Blue
Odour	Odourless.
Odour threshold	No information available

Property	**Values**	**Remarks • Method**
pH	3 (28%) - 4	None known
Melting point / freezing point	-4 °C / 24.8 °F	
Initial boiling point and boiling range		
Flash point	> 93.11 °C / 199.598 °F	(PMCC)
Evaporation rate	No data available	
Flammability	No data available	
Flammability Limit in Air		
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapour pressure	No data available	
Relative vapour density	No data available	
Relative density	1.16	
Water solubility	Soluble in water	
Solubility(ies)	No data available	
Partition coefficient	No data available	
Autoignition temperature	520 °C / 968 °F	
Decomposition temperature		
Kinematic viscosity	No data available	
Dynamic viscosity	15-30 cP @ 25°C	
Other information		
Pour Point	No data available	
VOC content	.?	
Liquid Density	9.66	
Particle characteristics	No information available	

Section 10: Stability and reactivity

Reactivity

Reactivity No information available.

Chemical stability

Stability Stable under normal conditions.

Explosion data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid None known based on information supplied.

Incompatible materials

Incompatible materials Strong oxidizers.

Hazardous decomposition products

Hazardous decomposition products Oxides of nitrogen. Oxides of sulfur. Carbon monoxide and carbon dioxide.

Section 11: Toxicological information

Information on likely routes of exposure

Principle Routes of Exposure Ingestion, Skin contact, Eye contact, Inhalation

Product Information

Inhalation Specific test data for the substance or mixture is not available.

Eye contact Specific test data for the substance or mixture is not available.

Skin contact Specific test data for the substance or mixture is not available.

Ingestion Specific test data for the substance or mixture is not available.

Symptoms No information available.

Acute toxicity .

Numerical measures of toxicity - Product Information
No information available

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	99,999.00	mg/kg
ATEmix (dermal)	99,999.00	mg/kg
ATEmix (inhalation-gas)	99,999.00	ppm
ATEmix (inhalation-vapour)	99,999.00	mg/l
ATEmix (inhalation-dust/mist)	99,999.00	mg/l

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation Based on available data, the classification criteria are not met.

Serious eye damage/eye irritation Based on available data, the classification criteria are not met.

Respiratory or skin sensitisation Based on available data, the classification criteria are not met.

Germ cell mutagenicity Based on available data, the classification criteria are not met.

Carcinogenicity Based on available data, the classification criteria are not met.

Reproductive toxicity	Based on available data, the classification criteria are not met.
STOT - single exposure	Based on available data, the classification criteria are not met.
STOT - repeated exposure	Based on available data, the classification criteria are not met.
Aspiration hazard	Based on available data, the classification criteria are not met.

Section 12: Ecological information

Ecotoxicity

Aquatic ecotoxicity

Unknown aquatic toxicity	8E-05 % of the mixture consists of component(s) of unknown hazards to the aquatic environment.
Terrestrial ecotoxicity	There is no data for this product.
Persistence and degradability	Based on available data, the classification criteria are not met
Bioaccumulation	There is no data for this product.
Mobility	Based on available data, the classification criteria are not met
Other adverse effects	No data available

Section 13: Disposal considerations

Disposal methods

Waste from residues/unused products	Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.
Contaminated packaging	Do not reuse empty containers.

See section 8 for more information

Section 14: Transport information

ADG	Not regulated
IATA	Not regulated
IMDG	Not regulated

Transport in bulk according to Annex II of MARPOL and the IBC Code
No information available

Section 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
Classified as a scheduled poison according to the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
Poison Schedule Number 10

Australian Industrial Chemicals Introduction Scheme (AICIS)
Contact supplier for inventory compliance status

Illicit Drug Precursors/Reagents
This product does not contain any substance(s) on the Illicit Drug Precursors/Reagents list.

International Inventories

TSCA	All components listed on inventory or are exempt
AIIC	All components listed on inventory or are exempt
NZIoC	All components listed on inventory or are exempt

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
AIIC - Australian Inventory of Industrial Chemicals
NZIoC - New Zealand Inventory of Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Not applicable

Section 16: Any other relevant information

Revision date 04-Oct-2024

Reason for revision Update to Format

Key or legend to abbreviations and acronyms used in the safety data sheet
ADR - The European Agreement concerning the International Carriage of Dangerous Goods by Road
bw – body weight
CAS – Chemical Abstracts Service
CLP – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Classification, Labelling and Packaging of substances and mixtures

EN 149 - European standard on filtering halfmasks to protect against particles
FFP - Filtering Facepieces
h - hour
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LL50 – Lethal Loading 50%
d - day
Derived No Effect Level (DNEL)
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
IATA/ICAO - International Air Transport Association / International Civil Aviation Organization
IMDG/IMO - International Maritime Dangerous Goods / International Maritime Organization
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
REACH – REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
VOC – Volatile Organic Carbon
UN – United Nations
VLA-EC - short-time excursion limits [Spain valores límite ambientales para la exposición de corta duración]
vPvB – very Persistent and very Bioaccumulative
w/w - weight/weight
Water hazard class (WGK)
UN – United Nations
VOC – Volatile Organic Carbon
TWA - Time-Weighted Average
STEL – Short Term Exposure Limit

Legend Section 8: Exposure controls/personal protection

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	Sk*	Skin designation
+	Sensitisers		

Key literature references and sources for data used to compile the SDS

Acute Exposure Guideline Level(s) (AEGL(s))
European Chemicals Agency (ECHA) (ECHA_API)
European Chemicals Agency (ECHA) Committee for Risk Assessment (ECHA_RAC)
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
NIOSH (National Institute for Occupational Safety and Health)

Disclaimer

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information isobtained from various sources including the manufacturer and other third party sources. The information may not be validunder all conditions nor if this material is used in combination with other materials or in any process. Final determination ofsuitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

STABILIZER 434D

Revision Date: 21-Mar-2022 **Revision Number:** 17

1. Product Identifier & Identity for the Chemical

Statement of Hazardous Nature Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

1.1. Product Identifier

Product Name STABILIZER 434D

Other means of Identification

Synonyms None

Hazardous Material Number: HM005734

Recommended use of the chemical and restrictions on use

Recommended Use Anionic Surfactant

Uses advised against No information available

Supplier's name, address and phone number

Manufacturer/Supplier Halliburton Australia Pty. Ltd.
15 Marriott Road, Jandakot, WA 6164
Australia
ACN Number: 009 000 775
Telephone Number: + 61 1 800 686 951
Fax Number: 61 (08) 9455 5300

E-mail Address fdunexchem@halliburton.com

Emergency phone number

+ 61 1 800 686 951
Global Incident Response Access Code: 334305
Contract Number: 14012

Australian Poisons Information Centre

24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

2. Hazard Identification

Statement of Hazardous Nature Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

Classification of the hazardous chemical

Skin Corrosion/Irritation	Category 2 - H315
Serious Eye Damage/Irritation	Category 1 - H318
Acute Aquatic Toxicity	Category 2 - H401
Chronic Aquatic Toxicity	Category 3 - H412

Label elements, including precautionary statements

Hazard Pictograms



Signal Word DANGER

Hazard Statements:
H315 - Causes skin irritation
H318 - Causes serious eye damage
H401 - Toxic to aquatic life
H412 - Harmful to aquatic life with long lasting effects

Precautionary Statements

Prevention
P264 - Wash face, hands and any exposed skin thoroughly after handling
P273 - Avoid release to the environment
P280 - Wear protective gloves/eye protection/face protection

Response
P302 + P352 - IF ON SKIN: Wash with plenty of water.
P332 + P313 - If skin irritation occurs: Get medical advice/attention
P362 + P364 - Take off contaminated clothing and wash before reuse
P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P310 - Immediately call a POISON CENTER or doctor/physician
P391 - Collect spillage

Storage None

Disposal P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

Contains

Substances	**CAS Number**
Alcohol ethoxy sulfate, sodium salt	68585-34-2

Other hazards which do not result in classification
None known

For the full text of the H-phrases mentioned in this Section, see Section 16

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - Australia
Alcohol ethoxy sulfate, sodium salt	68585-34-2	10 - 30%	Skin Irrit. 2 (H315) Eye Corr. 1 (H318) Aquatic Acute 2 (H401) Aquatic Chronic 3 (H412)

4. First aid measures

Description of necessary first aid measures

Inhalation If inhaled, move victim to fresh air and seek medical attention.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 30 minutes. Remove contact lenses after the first 5 minutes and continue washing. Seek immediate medical attention/advice. Suitable emergency eye wash facility should be immediately available

Skin In case of contact, immediately flush skin with plenty of soap and water for at least

	15 minutes. Get medical attention.
Ingestion	Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

Symptoms caused by exposure

Causes severe eye irritation which may damage tissue. Causes skin irritation.

Medical Attention and Special Treatment

Notes to Physician Treat symptomatically

5. Fire Fighting Measures

Suitable extinguishing equipment

Suitable Extinguishing Media

All standard fire fighting media

Extinguishing media which must not be used for safety reasons

None known.

Specific hazards arising from the chemical

Special exposure hazards in a fire

Use water spray to cool fire exposed surfaces.

Special protective equipment and precautions for fire fighters

Special protective equipment for firefighters

Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Use appropriate protective equipment.

6.2. Environmental precautions

Prevent from entering sewers, waterways, or low areas.

6.3. Methods and material for containment and cleaning up

Dike far ahead of liquid spill for later disposal. Soak up with inert absorbent material. Pick up and transfer to properly labeled containers.

7. Handling and storage

7.1. Precautions for safe handling

Handling Precautions

Only open container in preparation for use. Avoid contact with eyes, skin, or clothing. Material is slippery underfoot.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities

Storage Information

Store in a cool well ventilated area. Keep container closed when not in use. Store at temperatures between 70 and 120 F (21 and 49C) Product has a shelf life of 24 months.

Other Guidelines

No information available

8. Exposure Controls/Personal Protection

Control parameters - exposure standards, biological monitoring

Exposure Limits

Substances	CAS Number	Australia NOHSC	ACGIH TLV-TWA

Alcohol ethoxy sulfate, sodium salt	68585-34-2	Not applicable	Not applicable

Appropriate engineering controls

Engineering Controls Use in a well ventilated area.

Personal protective equipment (PPE)

Personal Protective Equipment If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

Respiratory Protection If engineering controls and work practices cannot keep exposure below occupational exposure limits or if exposure is unknown, wear a NIOSH certified, European Standard EN 149, AS/NZS 1715:2009, or equivalent respirator when using this product. Selection of and instruction on using all personal protective equipment, including respirators, should be performed by an Industrial Hygienist or other qualified professional. Organic vapor respirator.

Hand Protection Impervious gloves Manufacturer's directions for use should be observed because of great diversity of types.

Skin Protection Rubber apron.

Eye Protection Chemical goggles; also wear a face shield if splashing hazard exists.

Other Precautions Eyewash fountains and safety showers must be easily accessible.

Environmental Exposure Controls No information available

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Liquid **Color** Pale clear to light amber

Odor: Surfactant **Odor Threshold:** No information available

Property Remarks/ - Method	Values
pH:	7 - 8
Freezing Point / Range	No data available
Melting Point / Range	No data available
Pour Point / Range	No data available
Boiling Point / Range	77 - 82 °C / 170.6 - 179.6 °F
Flash Point	> 93 °C / > 200 °F (PMCC)
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	1.05 - 1.07
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

VOC Content (%) No data available

10. Stability and Reactivity

10.1. Reactivity

Not expected to be reactive.

10.2. Chemical stability

Stable

10.3. Possibility of hazardous reactions

Will Not Occur

10.4. Conditions to avoid

Do not expose to heat or store at temperatures above 120 F (49 C).

10.5. Incompatible materials

Strong oxidizers. Strong acids.

10.6. Hazardous decomposition products

Carbon oxides.

11. Toxicological Information

Information on routes of exposure

Principle Route of Exposure Eye or skin contact, inhalation.

Symptoms related to exposure

Most Important Symptoms/Effects

Causes severe eye irritation which may damage tissue. Causes skin irritation.

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Alcohol ethoxy sulfate, sodium salt	68585-34-2	> 2000 mg/kg (Rat) (similar substance)	> 2000 mg/kg (Rabbit) (similar substance)	No data available

Immediate, delayed and chronic health effects from exposure

Inhalation Inhalation of mist or heated vapors may cause respiratory irritation.

Eye Contact Causes severe eye irritation which may damage tissue.

Skin Contact Causes skin irritation.

Ingestion Irritation of the mouth, throat, and stomach.

Chronic Effects/Carcinogenicity No data available to indicate product or components present at greater than 0.1% are chronic health hazards.

Exposure Levels

No data available

Interactive effects

Skin disorders.

Data limitations

No data available

Substances	CAS Number	Skin corrosion/irritation
Alcohol ethoxy sulfate, sodium salt	68585-34-2	Skin, rabbit: Causes moderate skin irritation. (similar substances)

Substances	CAS Number	Serious eye damage/irritation
Alcohol ethoxy sulfate, sodium salt	68585-34-2	Causes moderate eye irritation (similar substances)

Substances	CAS Number	Skin Sensitization
Alcohol ethoxy sulfate, sodium salt	68585-34-2	Patch test on human volunteers did not demonstrate sensitization properties Did not cause sensitization on laboratory animals (similar substances)

Substances	CAS Number	Respiratory Sensitization
Alcohol ethoxy sulfate, sodium salt	68585-34-2	No information available

Substances	CAS Number	Mutagenic Effects
Alcohol ethoxy sulfate, sodium salt	68585-34-2	In vitro tests did not show mutagenic effects. In vivo tests did not show mutagenic effects. (similar substances)

Substances	CAS Number	Carcinogenic Effects
Alcohol ethoxy sulfate, sodium salt	68585-34-2	Did not show carcinogenic effects in animal experiments (similar substances)

Substances	CAS Number	Reproductive toxicity
Alcohol ethoxy sulfate, sodium salt	68585-34-2	Animal testing did not show any effects on fertility. (similar substances)

Substances	CAS Number	STOT - single exposure
Alcohol ethoxy sulfate, sodium salt	68585-34-2	No data of sufficient quality are available.

Substances	CAS Number	STOT - repeated exposure
Alcohol ethoxy sulfate, sodium salt	68585-34-2	No significant toxicity observed in animal studies at concentration requiring classification. (similar substances)

Substances	CAS Number	Aspiration hazard
Alcohol ethoxy sulfate, sodium salt	68585-34-2	Not applicable

12. Ecological Information

Ecotoxicity

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Alcohol ethoxy sulfate, sodium salt	68585-34-2	EC50 (5d) 101 mg/L (Selenastrum capricornutum) (Similar substances)	LC50 (45d) 0.9 mg/L (Pimephales promelas) NOEC (45d) 1 mg/L (Pimephales promelas) NOEC (28d) 0.12 mg/L (Oncorhynchus mykiss) (similar substance)	EC50 (3h) > 1600 mg/L (Unspecified) (similar substance)	EC50 (48h) 3.43 mg/L (Ceriodaphnia dubia) (similar substance) EC50 (24h) 21 mg/L (Daphnia magna) (similar substance) EC50 (96h) 5.7 mg/L (Daphnia magna) (similar substance) NOEC (7d) 0.34 mg/L (Ceriodaphnia dubia) (similar substance) NOEC (7d) 6.3 mg/L (Ceriodaphnia dubia) (similar substance) NOEC (21d) 0.27 mg/L (Daphnia magna) (similar substance) NOEC (21d) 16.5 mg/L (Daphnia magna) (similar substance)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Alcohol ethoxy sulfate, sodium salt	68585-34-2	Readily biodegradable

12.3. Bioaccumulative potential

Substances	CAS Number	Bioaccumulation
Alcohol ethoxy sulfate, sodium salt	68585-34-2	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Alcohol ethoxy sulfate, sodium salt	68585-34-2	No information available

12.6. Other adverse effects

Endocrine Disruptor Information

This product does not contain any known or suspected endocrine disruptors

13. Disposal Considerations

Safe handling and disposal methods

Disposal should be made in accordance with federal, state, and local regulations. Incineration recommended in approved incinerator according to federal, state, and local regulations.

Disposal of any contaminated packaging

Follow all applicable national or local regulations. Contaminated packaging may be disposed of by: rendering packaging incapable of containing any substance, or treating packaging to remove residual contents, or treating packaging to make sure the residual contents are no longer hazardous, or by disposing of packaging into commercial waste collection.

Environmental regulations

Not applicable

14. Transport Information

Transportation Information

Australia ADG

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

IMDG/IMO

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

IATA/ICAO

UN Number	Not restricted
UN proper shipping name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable

Special precautions during transport

None

HazChem Code

None Allocated

15. Regulatory Information

Safety, health and environmental regulations specific for the product

International Inventories

Australian AICS Inventory	All components are listed on the AIIC or are subject to a relevant exemption, permit, or assessment certificate.
New Zealand Inventory of	All components are listed on the NZIoC or are subject to a relevant exemption, permit, or

Chemicals	assessment certificate.
US TSCA Inventory	All components listed on inventory or are exempt.
Canadian Domestic Substances List (DSL)	All components listed on inventory or are exempt.

Poisons Schedule number
None Allocated

International Agreements

Montreal Protocol - Ozone Depleting Substances:	Does not apply.
Stockholm Convention - Persistent Organic Pollutants:	Does not apply
Rotterdam Convention - Prior Informed Consent:	Does not apply.
Basel Convention - Hazardous Waste:	Does not apply.

16. Other information

Date of preparation or review

Revision Date: 21-Mar-2022

Revision Note
SDS sections updated:

Full text of H-Statements referred to under sections 2 and 3
H315 - Causes skin irritation
H318 - Causes serious eye damage
H401 - Toxic to aquatic life
H412 - Harmful to aquatic life with long lasting effects

Additional information: For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Safety Data Sheet for this or other Halliburton products, contact Chemical Stewardship at 1-580-251-4335.

Key abreviations or acronyms used
bw – body weight
CAS – Chemical Abstracts Service
EC50 – Effective Concentration 50%
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
NOEC – No Observed Effect Concentration
OEL – Occupational Exposure Limit
PBT – Persistent Bioaccumulative and Toxic
ppm – parts per million
STEL – Short Term Exposure Limit
TWA – Time-Weighted Average
vPvB – very Persistent and very Bioaccumulative
h - hour
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
w/w - weight/weight
d - day

Key literature references and sources for data
www.ChemADVISOR.com/
NZ CCID

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End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

TUNED DEFENSE CEMENT SPACER

Revision date: 29-Jan-2024 **Revision Number:** 4

Section 1: Identification: Product identifier and chemical identity

Product identifier

Product Name TUNED DEFENSE CEMENT SPACER

Product Code(s) HM008976

Other means of identification

Pure substance/mixture Mixture

Recommended use of the chemical and restrictions on use

Recommended use Cement Additive
Uses advised against No information available.

Details of manufacturer or importer

Halliburton Australia Pty. Ltd.
15 Marriott Road, Jandakot, WA 6164
Australia
ACN Number: 009 000 775
Telephone Number: + 61 (08) 6424 4800

For further information, please contact

fdunexchem@halliburton.com

Emergency telephone number

Australia Emergency Telephone Number + 61 1 800 686 951
Global Incident Response Access Code: 334305
Contract Number: 14012

Australian Poisons Information Centre 24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

Section 2: Hazard(s) identification

Statement of Hazardous Nature: Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

GHS Classification

Carcinogenicity	Category 1A

Label elements

Signal word
DANGER

Hazard statements
May cause cancer by inhalation.

Precautionary Statements - Prevention
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Wear protective gloves/eye protection/face protection.
Precautionary Statements - Response
IF exposed or concerned: Get medical advice/attention.
Precautionary Statements - Storage
Store locked up.
Precautionary Statements - Disposal
Dispose of contents/container in accordance with local, regional, national, and international regulations as applicable.

Other hazards which do not result in classification
No information available.

Section 3: Composition/information on ingredients

Chemical name	CAS No.	Weight-%
Crystalline silica, quartz	14808-60-7	0.1 - 1%

Section 4: First aid measures

Description of first aid measures

Inhalation Remove to fresh air.

Eye contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a doctor.

Skin contact Wash skin with soap and water.

Ingestion Rinse mouth.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Effects of Exposure May cause cancer by inhalation.

Indication of any immediate medical attention and special treatment needed

Note to doctors Treat symptomatically.

Section 5: Firefighting measures

Suitable Extinguishing Media

Suitable extinguishing media Water fog, carbon dioxide, foam, dry chemical.

Large Fire CAUTION: Use of water spray when fighting fire may be inefficient.

Unsuitable extinguishing media Do not scatter spilled material with high pressure water streams.

Specific hazards arising from the chemical

Specific hazards arising from the No information available.

chemical

Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C). Carbon monoxide and carbon dioxide.

Special protective actions for fire-fighters

Special protective equipment and precautions for fire-fighters Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protection equipment.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation.

For emergency responders Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Precautions to prevent secondary hazards

Prevention of secondary hazards Clean contaminated objects and areas thoroughly observing environmental regulations.

Section 7: Handling and storage, including how the chemical may be safely used

Precautions for safe handling

Advice on safe handling Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Conditions Store away from acids. Store in a cool, dry location. Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container. Product has a shelf life of 24 months. Avoid contact with heat, sparks, open flame, and static discharge.

Incompatible materials Strong oxidizers. Strong acids. Strong alkalis.

Section 8: Exposure controls and personal protection

Working area parameters, subject to mandatory control (MAC or TSEL)

Exposure Limits This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Chemical name	Australia	New Zealand	ACGIH TLV
Crystalline silica, quartz 14808-60-7	TWA: 0.05 mg/m³	TWA: 0.025 mg/m³	-

Chemical name	OSHA PEL	NIOSH
Crystalline silica, quartz	TWA: 50 µg/m³	IDLH: 50 mg/m³ respirable dust

14808-60-7	(vacated) TWA: 0.1 mg/m³ respirable dust : (250)/(%SiO2 + 5) mppcf TWA respirable fraction : (10)/(%SiO2 + 2) mg/m³ TWA respirable fraction	TWA: 0.05 mg/m³ respirable dust

Biological occupational exposure limits This product, as supplied, does not contain any hazardous materials with biological limits established by the region specific regulatory bodies

Appropriate engineering controls

Engineering controls Localized ventilation should be used to control dust levels.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses or goggles to protect against exposure. (EN-166).

Skin and body protection Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

Hand protection Use gloves which are suitable for the chemicals present in this product as well as other environmental factors in the workplace. Suitable materials for longer, direct contact (recommended: protection index 6, corresponding to > 480 minutes permeation time as per EN 374):. Nitrile gloves.

Respiratory protection If engineering controls and work practices cannot keep exposure below occupational exposure limits or if exposure is unknown, wear a NIOSH certified, European Standard EN 149, AS/NZS 1715:2009, or equivalent respirator when using this product. Selection of and instruction on using all personal protective equipment, including respirators, should be performed by an Industrial Hygienist or other qualified professional. Dust/mist respirator. (N95, P2/P3).

Environmental exposure controls No information available.

Other protective equipment Eyewash fountains and safety showers must be easily accessible.

Thermal hazards No information available.

Section 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state Solid
Appearance No information available
Colour Dark brown
Odour No information available.
Odour threshold No information available

Property	Values	Remarks • Method
pH	No data available	
Melting point / freezing point	No data available	
Initial boiling point and boiling range		
Flash point	No data available	
Evaporation rate	No data available	
Flammability	No data available	
Flammability Limit in Air		
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	

Vapour pressure	No data available
Relative vapour density	No data available
Relative density	No data available
Water solubility	Insoluble in water
Solubility(ies)	No data available
Partition coefficient	No data available
Autoignition temperature	No data available
Decomposition temperature	
Kinematic viscosity	No data available
Dynamic viscosity	No data available
Other information	
Pour Point	No data available
VOC content	No information available
Particle characteristics	No information available

Section 10: Stability and reactivity

Reactivity

Reactivity No information available.

Chemical stability

Stability Stable under normal conditions.

Explosion data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid None known based on information supplied.

Incompatible materials

Incompatible materials Strong oxidizers. Strong acids. Strong alkalis.

Hazardous decomposition products

Hazardous decomposition products Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C). Carbon monoxide and carbon dioxide.

Section 11: Toxicological information

Information on likely routes of exposure

Principle Routes of Exposure Ingestion, Skin contact, Eye contact, Inhalation

Product Information

Inhalation Specific test data for the substance or mixture is not available.

Eye contact Specific test data for the substance or mixture is not available.

Skin contact Specific test data for the substance or mixture is not available.

Ingestion Specific test data for the substance or mixture is not available.

Symptoms No information available.

Acute toxicity .

Numerical measures of toxicity - Product Information
No information available

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Crystalline silica, quartz	> 15000 mg/kg (human)	-	-

See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation

Chemical name	**Skin corrosion/irritation**
Crystalline silica, quartz 14808-60-7	Non-irritating to the skin

Serious eye damage/eye irritation

Chemical name	**Serious eye damage/eye irritation**
Crystalline silica, quartz 14808-60-7	Non-irritating to the eye

Respiratory or skin sensitisation

Chemical name	Respiratory sensitisation
Crystalline silica, quartz 14808-60-7	Not classified
Chemical name	**Skin sensitisation**
Crystalline silica, quartz 14808-60-7	Not classified

Germ cell mutagenicity

Chemical name	**Germ cell mutagenicity**
Crystalline silica, quartz 14808-60-7	Not regarded as mutagenic.

Carcinogenicity

Chemical name	**Carcinogenicity**
Crystalline silica, quartz 14808-60-7	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure.

Chemical name	Australia	European Union	IARC
Crystalline silica, quartz - 14808-60-7	Carc. 1A	-	Group 1

Reproductive toxicity

Chemical name	**Reproductive toxicity**
Crystalline silica, quartz 14808-60-7	This product does not contain any known or suspected reproductive hazards

STOT - single exposure

Chemical name	STOT - single exposure
Crystalline silica, quartz 14808-60-7	No significant toxicity observed in animal studies at concentration requiring classification.

STOT - repeated exposure

Chemical name	STOT - repeated exposure
Crystalline silica, quartz 14808-60-7	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)

Aspiration hazard

Chemical name	Aspiration hazard
Crystalline silica, quartz 14808-60-7	Based on available data, the classification criteria are not met

Section 12: Ecological information

Ecotoxicity Based on available data, the classification criteria are not met

Chemical name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Crystalline silica, quartz	EC50(72 h)=440 mg/L (Pseudokirchneriella subcapitata)	LL0(96 h)=10000 mg/L (Danio rerio)	-	LL50(24 h)>10000 mg/L (Daphnia magna)

Terrestrial ecotoxicity There is no data for this product.

Persistence and degradability

Chemical name	Persistence and degradability
Crystalline silica, quartz 14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.

Bioaccumulation There is no data for this product.

Mobility Based on available data, the classification criteria are not met

Chemical name	Mobility
Crystalline silica, quartz 14808-60-7	No information available

Other adverse effects No data available

Section 13: Disposal considerations

Disposal methods

Waste from residues/unused products Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.

Contaminated packaging Do not reuse empty containers.

See section 8 for more information

Section 14: Transport information

ADG Not regulated

IATA Not regulated

IMDG Not regulated

Transport in bulk according to Annex II of MARPOL and the IBC Code
No information available

Section 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
No poisons schedule number allocated

Australian Industrial Chemicals Introduction Scheme (AICIS)
Contact supplier for inventory compliance status

Chemical name	Australian Industrial Chemicals Introduction Scheme (AICIS)	Additional information
Crystalline silica, quartz - 14808-60-7	Contact supplier for inventory compliance status	-

Illicit Drug Precursors/Reagents
This product does not contain any substance(s) on the Illicit Drug Precursors/Reagents list.

International Inventories

TSCA	All components listed on inventory or are exempt
AIIC	Product contains one or more components not listed on inventory
NZIoC	Product contains one or more components not listed on inventory

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
AIIC - Australian Inventory of Industrial Chemicals
NZIoC - New Zealand Inventory of Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Not applicable

Section 16: Any other relevant information

Revision date 29-Jan-2024

Reason for revision Update to Format

Key or legend to abbreviations and acronyms used in the safety data sheet

ADR - The European Agreement concerning the International Carriage of Dangerous Goods by Road
bw – body weight
CAS – Chemical Abstracts Service
CLP – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Classification, Labelling and Packaging of substances and mixtures
EN 149 - European standard on filtering halfmasks to protect against particles
FFP - Filtering Facepieces
h - hour
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LL50 – Lethal Loading 50%
d - day
Derived No Effect Level (DNEL)
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
IATA/ICAO - International Air Transport Association / International Civil Aviation Organization
IMDG/IMO - International Maritime Dangerous Goods / International Maritime Organization
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
REACH – REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
VOC – Volatile Organic Carbon
UN – United Nations
VLA-EC - short-time excursion limits [Spain valores límite ambientales para la exposición de corta duración]
vPvB – very Persistent and very Bioaccumulative
w/w - weight/weight
Water hazard class (WGK)
UN – United Nations
VOC – Volatile Organic Carbon
TWA - Time-Weighted Average
STEL – Short Term Exposure Limit

Legend Section 8: Exposure controls/personal protection

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	Sk*	Skin designation
+	Sensitisers		

Key literature references and sources for data used to compile the SDS

Acute Exposure Guideline Level(s) (AEGL(s))
European Chemicals Agency (ECHA) (ECHA_API)
European Chemicals Agency (ECHA) Committee for Risk Assessment (ECHA_RAC)
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
NIOSH (National Institute for Occupational Safety and Health)

Disclaimer

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End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

TUNED® SPACER III

Revision date: 10-Jan-2024 **Revision Number:** 34

Section 1: Identification: Product identifier and chemical identity

Product identifier

Product Name TUNED® SPACER III

Product Code(s) HM005735

Other means of identification

Pure substance/mixture Mixture

Recommended use of the chemical and restrictions on use

Recommended use Cement Spacer
Uses advised against No information available.

Details of manufacturer or importer

Halliburton Australia Pty. Ltd.
15 Marriott Road, Jandakot, WA 6164
Australia
ACN Number: 009 000 775
Telephone Number: + 61 (08) 6424 4800

For further information, please contact

fdunexchem@halliburton.com

Emergency telephone number

Australia Emergency Telephone Number + 61 1 800 686 951
Global Incident Response Access Code: 334305
Contract Number: 14012

Australian Poisons Information Centre 24 Hour Service: - 13 11 26
Police or Fire Brigade: - 000 (exchange): - 1100

Section 2: Hazard(s) identification

Statement of Hazardous Nature: Hazardous according to the criteria of the 7th Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), Non-Dangerous Goods according to the criteria of ADG.

GHS Classification

Carcinogenicity	Category 1A
Specific target organ toxicity (repeated exposure)	Category 1

Label elements



Signal word
DANGER

Hazard statements
May cause cancer.
Causes damage to organs through prolonged or repeated exposure.

Precautionary Statements - Prevention
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Wear protective gloves/clothing and eye/face protection.
Wash face, hands and any exposed skin thoroughly after handling.
Do not eat, drink or smoke when using this product.
Precautionary Statements - Response
IF exposed or concerned: Get medical advice/attention.
Precautionary Statements - Storage
Store locked up.
Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant.

Other hazards which do not result in classification
No information available.

Section 3: Composition/information on ingredients

Chemical name	CAS No.	Weight-%
Crystalline silica, quartz	14808-60-7	60 - 100%
Non-hazardous ingredients	Proprietary	Balance

If CAS number is "proprietary", the specific chemical identity and percentage of composition has been withheld as a trade secret

Section 4: First aid measures

Description of first aid measures

General advice IF exposed or concerned: Get medical advice/attention.

Inhalation Remove to fresh air.

Eye contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a doctor.

Skin contact Wash skin with soap and water.

Ingestion Rinse mouth.

Most important symptoms and effects, both acute and delayed

Symptoms No information available.

Effects of Exposure May cause cancer. Causes damage to organs through prolonged or repeated exposure.

Indication of any immediate medical attention and special treatment needed

Note to doctors	Treat symptomatically.

Section 5: Firefighting measures

Suitable Extinguishing Media

Suitable extinguishing media	All standard fire fighting media.
Large Fire	CAUTION: Use of water spray when fighting fire may be inefficient.
Unsuitable extinguishing media	Do not scatter spilled material with high pressure water streams.

Specific hazards arising from the chemical

Specific hazards arising from the chemical	No information available. Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

Special protective actions for fire-fighters

Special protective equipment and precautions for fire-fighters	Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear. Use personal protective equipment.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

Personal precautions	Ensure adequate ventilation.
Other information	Refer to protective measures listed in Sections 7 and 8.
For emergency responders	Use personal protection recommended in Section 8.

Environmental precautions

Environmental precautions	See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment	Prevent further leakage or spillage if safe to do so.

Precautions to prevent secondary hazards

Prevention of secondary hazards	Clean contaminated objects and areas thoroughly observing environmental regulations.

Section 7: Handling and storage, including how the chemical may be safely used

Precautions for safe handling

Advice on safe handling	Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing.
General hygiene considerations	If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this

product. Do not eat, drink or smoke when using this product. Wash hands before breaks and immediately after handling the product.

Conditions for safe storage, including any incompatibilities

Storage Conditions Do not reuse empty container. Store in a well ventilated area. Keep container closed when not in use. Store locked up.

Incompatible materials Hydrofluoric acid.

Section 8: Exposure controls and personal protection

Control Parameters

Exposure Limits

Chemical name	Australia	New Zealand	ACGIH TLV
Crystalline silica, quartz 14808-60-7	TWA: 0.05 mg/m³	TWA: 0.025 mg/m³	TWA: 0.025 mg/m³ respirable particulate matter

Chemical name	OSHA PEL	NIOSH
Crystalline silica, quartz 14808-60-7	TWA: 50 µg/m³ (vacated) TWA: 0.1 mg/m³ respirable dust : (250)/(%SiO2 + 5) mppcf TWA respirable fraction : (10)/(%SiO2 + 2) mg/m³ TWA respirable fraction	IDLH: 50 mg/m³ respirable dust TWA: 0.05 mg/m³ respirable dust

Biological occupational exposure limits This product, as supplied, does not contain any hazardous materials with biological limits established by the region specific regulatory bodies

Appropriate engineering controls

Engineering controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses or goggles to protect against exposure. (EN-166). Wear safety glasses with side shields (or goggles).

Skin and body protection Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing. Wear suitable protective clothing.

Hand protection Normal work gloves. Wear suitable gloves.

Respiratory protection Wear a NIOSH certified, European Standard EN 149 (FFP2/FFP3), AS/NZS 1715, or equivalent respirator when using this product.
Use appropriate respiratory protection.

Environmental exposure controls No information available.

Other protective equipment None known. Eyewash fountains and safety showers must be easily accessible.

Thermal hazards No information available.

Section 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state	Solid
Appearance	No information available
Colour	Dark grey
Odour	Odourless.
Odour threshold	No information available

Property	**Values**	**Remarks • Method**
pH	No data available	
Melting point / freezing point	No data available	
Initial boiling point and boiling range		
Flash point	No data available	
Evaporation rate	No data available	
Flammability	No data available	
Flammability Limit in Air		
Upper flammability or explosive limits	No data available	
Lower flammability or explosive limits	No data available	
Vapour pressure	No data available	
Relative vapour density	No data available	
Relative density	2.51	
Water solubility	Insoluble in water	
Solubility(ies)	No data available	
Partition coefficient	No data available	
Autoignition temperature	No data available	
Decomposition temperature		
Kinematic viscosity	No data available	
Dynamic viscosity	No data available	
Other information		
Pour Point	No data available	
VOC content	No information available	
Particle characteristics	No information available	

Section 10: Stability and reactivity

Reactivity

Reactivity No information available.

Chemical stability

Stability Stable under normal conditions.

Explosion data

Sensitivity to mechanical impact None.

Sensitivity to static discharge None.

Possibility of hazardous reactions

Possibility of hazardous reactions None under normal processing.

Conditions to avoid

Conditions to avoid None known based on information supplied.

Incompatible materials

Incompatible materials Hydrofluoric acid.

Hazardous decomposition products

Hazardous decomposition products Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

Section 11: Toxicological information

Information on likely routes of exposure

Principle Routes of Exposure Eye or skin contact, inhalation, Ingestion

Product Information

Inhalation Specific test data for the substance or mixture is not available.

Eye contact Specific test data for the substance or mixture is not available.

Skin contact Specific test data for the substance or mixture is not available.

Ingestion Specific test data for the substance or mixture is not available.

Symptoms No information available.

Acute toxicity .

Numerical measures of toxicity - Product Information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	99,999.00	mg/kg
ATEmix (dermal)	99,999.00	mg/kg
ATEmix (inhalation-gas)	99,999.00	ppm
ATEmix (inhalation-vapour)	99,999.00	mg/L
ATEmix (inhalation-dust/mist)	99,999.00	mg/L

Component Information
See section 16 for terms and abbreviations

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation

Serious eye damage/eye irritation

Respiratory or skin sensitisation

Germ cell mutagenicity

Carcinogenicity Contains a known or suspected carcinogen. Classification based on data available for ingredients. May cause cancer.

The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical name	Australia	European Union	IARC
Crystalline silica, quartz - 14808-60-7	Carc. 1A	-	Group 1

Legend

IARC (International Agency for Research on Cancer)
Group 1 - Carcinogenic to humans

Reproductive toxicity

STOT - single exposure

STOT - repeated exposure Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard

Section 12: Ecological information

Ecotoxicity Based on available data, the classification criteria are not met

Terrestrial ecotoxicity There is no data for this product.

Persistence and degradability

Bioaccumulation There is no data for this product.

Mobility Based on available data, the classification criteria are not met

Other adverse effects No data available

Section 13: Disposal considerations

Disposal methods

Waste from residues/unused products Dispose of in accordance with local regulations. Dispose of waste in accordance with environmental legislation.

Contaminated packaging Do not reuse empty containers.

See section 8 for more information

Section 14: Transport information

ADG Not regulated

IATA Not regulated

IMDG Not regulated

Transport in bulk according to Annex II of MARPOL and the IBC Code
No information available

Section 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations

Australia

See section 8 for national exposure control parameters

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)
No poisons schedule number allocated

Australian Industrial Chemicals Introduction Scheme (AICIS)

Chemical name	Australian Industrial Chemicals Introduction Scheme (AICIS)	Additional information
Crystalline silica, quartz - 14808-60-7	Present	-

Illicit Drug Precursors/Reagents
This product does not contain any substance(s) on the Illicit Drug Precursors/Reagents list.

International Inventories

TSCA	All components listed on inventory or are exempt
AIIC	All components listed on inventory or are exempt
NZIoC	All components listed on inventory or are exempt

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
AIIC - Australian Inventory of Industrial Chemicals
NZIoC - New Zealand Inventory of Chemicals

International Regulations

The Montreal Protocol on Substances that Deplete the Ozone Layer Not applicable

The Stockholm Convention on Persistent Organic Pollutants Not applicable

The Rotterdam Convention Not applicable

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal Not applicable

Section 16: Any other relevant information

Revision date 10-Jan-2024

Reason for revision Update to Format

Key or legend to abbreviations and acronyms used in the safety data sheet
ADR - The European Agreement concerning the International Carriage of Dangerous Goods by Road
bw – body weight

CAS – Chemical Abstracts Service
CLP – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Classification, Labelling and Packaging of substances and mixtures
EN 149 - European standard on filtering halfmasks to protect against particles
FFP - Filtering Facepieces
h - hour
IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LL50 – Lethal Loading 50%
d - day
Derived No Effect Level (DNEL)
EC – European Commission
EC10 – Effective Concentration 10%
EC50 – Effective Concentration 50%
EEC – European Economic Community
IATA/ICAO - International Air Transport Association / International Civil Aviation Organization
IMDG/IMO - International Maritime Dangerous Goods / International Maritime Organization
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
NTP – National Toxicology Program
OEL – Occupational Exposure Limit
PEL – Permissible Exposure Limit
ppm – parts per million
REACH – REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
VOC – Volatile Organic Carbon
UN – United Nations
VLA-EC - short-time excursion limits [Spain valores límite ambientales para la exposición de corta duración]
vPvB – very Persistent and very Bioaccumulative
w/w - weight/weight
Water hazard class (WGK)
UN – United Nations
VOC – Volatile Organic Carbon
TWA - Time-Weighted Average
STEL – Short Term Exposure Limit

Legend Section 8: Exposure controls/personal protection

TWA	TWA (time-weighted average)	STEL	STEL (Short Term Exposure Limit)
Ceiling	Maximum limit value	Sk*	Skin designation
+	Sensitisers		

Key literature references and sources for data used to compile the SDS

Acute Exposure Guideline Level(s) (AEGL(s))
European Chemicals Agency (ECHA) (ECHA_API)
European Chemicals Agency (ECHA) Committee for Risk Assessment (ECHA_RAC)
Hazardous Substance Database
International Uniform Chemical Information Database (IUCLID)
NIOSH (National Institute for Occupational Safety and Health)

Disclaimer

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information isobtained from various sources including the manufacturer and other third party sources. The information may not be validunder all conditions nor if this material is used in combination with other materials or in any process. Final determination ofsuitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

SAFETY DATA SHEET

ALL-TEMP™

Version 4

Section 1. Identification

Product identifier : ALL-TEMP™

Product code : 1061DF

ADG : -

Product type : Powder.

Identified uses : Deflocculant

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

There are no ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Section 4. First aid measures

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,sulfur oxides,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid breathing dust. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Section 8. Exposure controls and personal protection

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): Wear suitable gloves tested to EN374.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Off-white. to White.

Odour : Odourless.

Odour threshold : Not available.

pH : 8 [Conc. (% w/w): 1% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : Not available.

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Section 9. Physical and chemical properties and safety characteristics

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Additional information : Bulk density: 0.4731 g/ml

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Section 11. Toxicological information

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : Not determined.

Section 15. Regulatory information

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Additional information

Conforms to Brazil Regulation ABNT NBR 14725 (1-4) regarding the Global Harmonization System (GHS)

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 20 February 2024

Date of previous issue : 10 March 2023

Version : 4

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Section 16. Any other relevant information

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

OVA COL 110 HC

Section 1. Identification

Product identifier	:	OVA COL 110 HC
Product code	:	OVA COL 110 HC
ADG	:	-
Product type	:	Liquid
Identified uses	:	Shale Stabiliser
Importer's details	:	Baker Hughes, Australia 631 Karel Avenue, Jandakot, Western Australia 6164, Australia Tel: 08 6595 7100
Manufacturer's details	:	OVA CHEM SDN. BHD. A Barium Selat Company No 6-1, Jalan Tasik Utama 7, Medan Niaga Tasik Damai, 57000 Sungai Besi, Kuala Lumpur. Tel/Fax: +603 9054 1203
Emergency telephone number	:	CHEMTREC Emergency Telephone Numbers (Asia Pacific Region): - Australia: (02) 9037 2994 - Brunei: +(65)-31581349 (Mandarin/English) - China: 4001-204937 (Mandarin) * - Hong Kong: 800-968-793 (Cantonese) * - Indonesia: 001-803-017-9114 (Bahasa Indonesian) * - Japan: +(81)-345209637 (Japanese) - Malaysia: 1-800-815-308 (Bahasa Malay) * - New Zealand: 09 801 0034 - Philippines: 1-800-1-116-1020 (Tagalog) * - PNG: +(61) 2 9037 2994 - Singapore: 800-101-2201 (Mandarin) * - South Korea: 00-308-13-2549 (Korean) * - Taiwan: 00801-14-8954 (Mandarin) * - Thailand: 001-800-13-203-9987 (Thai) * - Vietnam: +(84)-838012436 (Vietnamese) - UK: +(44) 870-820-0418 - USA: +(1) 703-527-3887 (CHEMTREC International 24 hour) * Number can only be dialled in-country
Date	:	06 May 2024

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OVACHEM
Tomorrow's Chemistry Today

a Barium Selat Company

Safety Data Sheet
OVA COL 110 HC

Section 1: Chemical Product and Company Identification

Product Name: OVA COL 110 HC

CAS#: 9004-77-7

EC-No.: 500-012-0

TSCA: Not applicable.

CI#: Not applicable.

Synonym: Not applicable.

Chemical Name: Polyethylene glycol

Chemical Formula: Not available

Contact Information:

OVA CHEM SDN. BHD.
No 6-1, Jalan Tasik Utama 7
Medan Niaga Tasik Damai
57000 Sungai Besi, Kuala Lumpur.
Tel/Fax: +603 9054 1203

For emergency assistance, call: +6012 368 3559

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Polyethylene Glycol.	Properitary	60 – 100%

Toxicological Data on Ingredients: Not available.

Section 3: Hazards Identification

OSHA Hazards: Target Organ Effect

Target Organs: Female reproductive system, Male reproductive system

GHS Label elements, including precautionary statements:

Pictogram



Signal Word — Warning

Hazard statement(s)
H302 + H312 — Harmful if swallowed or in contact with skin.

Precautionary statement(s)

P280	Wear protective gloves/protective clothing.

HMIS Classification

Health hazard:	1
Chronic health hazard:	*
Flammability:	0
Physical hazards:	0

NFPA Rating

Health hazard:	0
Fire:	0
Reactivity Hazard:	0

Potential Health Effects

Inhalation:	May be harmful if inhaled. May cause respiratory tract irritation.
Skin:	May be harmful if absorbed through skin. May cause skin irritation.
Eyes:	May cause eye irritation.
Inhestion:	May be harmful if swallowed.

Section 4: First Aid Measures

Eye Contact:
In case of contact with eyes, rinse with plenty of water and contact Doctor of Poisons Information Centre.

Skin Contact:
If skin or hair contact occurs, flush skin and hair with running water (and soap if available) and seek medical attention in event of irritation.

Inhalation:
If inhaled, remove to fresh air. Keep person warm and at rest. If not breathing or breathing is difficult, provide artificial respiration and oxygen by trained personnel. Get medical attention if symptoms appear.

Ingestion:
Wash out mouth with water. Never give anything by mouth to an unconscious person. Get medical attention if symptoms appear.

Section 5: Fire and Explosion Data

Extinguishing media: If extinction, use dry chemical powder, foam, BCF (where regulation permit), carbon dioxide or water spray or fog if large fires extinction.

Special exposure hazard: Heating may cause expansion or decomposition leading to violent rupture of containers. Mists containing combustible materials may be explosive. Slight fire hazard when exposed to heat or flame.

Hazardous thermal decomposition products : Decomposition products may include the following materials: carbon dioxide, carbon monoxide, acrid smoke, other pyrolysis products typical of burning organic material, poisonous fumes and corrosive fumes.

Advice for fire-fighters: Fire-fighters should wear appropriate protective equipment.

Fire Incompatibility: Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Section 6: Accidental Release Measures

Personal precautions, protective equipment and emergency procedures:
Take note of any information in Section 8 on suitable and unsuitable materials, if specialised clothing is required to deal with the spillage.

Environmental precautions:
Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollutions.

Small spill:
Stop leak if without risk and move containers from spill area. If water soluble, dilute it with water. If absorb with an inert dry material, mop up. Place in an appropiate waste disposal container and dispose of via a licensed waste disposal contractor.

Large spill:
Stop leak if without risk and move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. earth, sand, vermiculite or diatomaceous earth and place in container for disposal according to local regulations and dispose of via a licensed waste disposal contractor.

Section 7: Handling and Storage

Precautions:
Do not eat, drink and smoke in areas where this material is handled, stored and processed. Wash hands and face after handled this material.
Storage:
Keep it in a dry, cool and well-ventilated area. Keep container tightly closed and sealed until ready for use.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
To minimize exposures, ensure adequate ventilation.
Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Pale yellow liquid

Odor: Faint

Taste: Not available.

Molecular Weight: not available

pH (50%): 6 - 9

Boiling Point: > 250°C

Flash Point: > 100°C

Auto Ignition Temperature: > 280°C

Specific Gravity: 1.0 – 1.1

Vapor Pressure: Not applicable.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Soluble in water

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Reactivity: No specific data.

Instability Temperature: Not available.

Conditions to avoid: No specific data.

Incompatibility with various substances: No specific data.

Corrosivity: Not available.

Special Remarks on Corrosivity: Not available.

Section 11: Toxicological Information

Acute toxicity: No data available.

Skin irritation/Corrosion: No data available.

Serious eye damage/eye irritation: No data available.

Respiratory or skin sensitization: No data available.

Germ cell mutagenicity: No data available.

Carcinogenicity:

IARC:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity: No data available

Specific target organ toxicity - single exposure (Globally Harmonized System): No data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System): No data available

Aspiration hazard: No data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

Burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting, Lachrymation, Conjunctivitis., Stomach/intestinal disorders

Additional Information

Section 12: Ecological Information

Ecotoxicity and aqua toxicity: Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested). LC50 (Lepomis macrochirus (Bluegill sunfish)): 10,650 mg/l Exposure time: 96.0 h LC50 (Gambusia affinis (Mosquito fish)): 13,400 mg/l Exposure time: 96.0 h

Biodegradability: Bio degradable

Bioaccumulation: : This substance is not considered to be persistent, bioaccumulating and toxic (PBT). This substance is not considered to be very persistent and very bioaccumulating (vPvB)

Mobility in soil: Potential for mobility in soil is very high (Koc between 0 and 50)

Section 13: Disposal Considerations

Waste Disposal:
The generation of waste should be avoided or minimised wherever possible. Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

	Land Transport (ADR/RID)	*Sea Transport (IMDG)*	*Air Transport (ICAO/IATA)*
UN-Number:	Not regulated	Not regulated	Not regulated
UN Proper shipping name:	Not regulated	Not regulated	Not regulated
Transport hazard class:	Not regulated	Not regulated	Not regulated
Packaging group:	Not regulated	Not regulated	Not regulated
Environmental hazards:	No	No	No
Special precautions for user:	See section 3	See section 3	See section 3
Transport in bulk according to Annex II of MARPOL and IBC code:	Not regulated	Not regulated	Not regulated

Section 15: Other Regulatory Information

EU Regulations: None of the components are listed.

Other EU Regulations: All components are exempted.

Chemical Safety Assessment:
This product contains substances for which Chemical Safety Assessments are still required.

Section 16: Other Information

Other Special Considerations: Not available.

Date updated: 3/10/2022

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SAFETY DATA SHEET

OVA TRICIDE 70

Section 1. Identification

Product identifier	:	OVA TRICIDE 70
Product code	:	OVA TRICIDE 70
ADG	:	AMINES, LIQUID, CORROSIVE, N.O.S. (contains triazine)
Product type	:	Liquid
Identified uses	:	Biocide
Importer's details	:	Baker Hughes, Australia 631 Karel Avenue, Jandakot, Western Australia 6164, Australia Tel: 08 6595 7100
Manufacturer's details	:	OVA CHEM SDN. BHD. A Barium Selat Company No 6-1, Jalan Tasik Utama 7, Medan Niaga Tasik Damai, 57000 Sungai Besi, Kuala Lumpur. Tel/Fax: +603 9054 1203
Emergency telephone number	:	CHEMTREC Emergency Telephone Numbers (Asia Pacific Region): - Australia: (02) 9037 2994 - Brunei: +(65)-31581349 (Mandarin/English) - China: 4001-204937 (Mandarin) * - Hong Kong: 800-968-793 (Cantonese) * - Indonesia: 001-803-017-9114 (Bahasa Indonesian) * - Japan: +(81)-345209637 (Japanese) - Malaysia: 1-800-815-308 (Bahasa Malay) * - New Zealand: 09 801 0034 - Philippines: 1-800-1-116-1020 (Tagalog) * - PNG: +(61) 2 9037 2994 - Singapore: 800-101-2201 (Mandarin) * - South Korea: 00-308-13-2549 (Korean) * - Taiwan: 00801-14-8954 (Mandarin) * - Thailand: 001-800-13-203-9987 (Thai) * - Vietnam: +(84)-838012436 (Vietnamese) - UK: +(44) 870-820-0418 - USA: +(1) 703-527-3887 (CHEMTREC International 24 hour) * Number can only be dialled in-country
Date	:	20 May 2024

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OVACHEM
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Safety Data Sheet
OVA TRICIDE 70%

Section 1: Chemical Product and Company Identification

Product Name: OVA TRICIDE 70

CAS#: Not available.

RTECS: Not available.

TSCA: Not available.

CI#: Not available.

Synonym: Biocide

Chemical Name: Triazine based

Chemical Formula: Not available

Contact Information:

OVA CHEM SDN. BHD.
No 6, Jalan Tasik Utama 7
Medan Niaga Tasik Damai
57000 Sungai Besi, Kuala Lumpur.
Tel/Fax: +603 9054 1203

For emergency assistance, call: +6012 368 3559

Section 2: Composition and Information on Ingredients

Composition: Mixture

Name	CAS #	% by Weight
Triazine	Various	70-80
Water	7732-18-5	20-30

Section 3: Hazards Identification

Health Hazard: H304-May be fatal if swallowed

H315-Causes skin irritation

H319-Causes serious eye irritation

H336-May cause dizziness

Physical Hazard: No data available



Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact:

Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used.

Inhalation:

Remove source of contamination or move victim to fresh air. Apply artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult. Get immediate medical attention.

Ingestion:

If burn is present, treat as any thermal burn, after decontamination. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient. No specific antidote. Due to irritant properties, swallowing may result in burns/ulceration of mouth, stomach and lower gastrointestinal tract with subsequent stricture. Aspiration of vomitus may cause lung injury. Suggest endotracheal/esophageal control if lavage is done.

Section 5: Fire and Explosion Data

Flash Point: > 150 ˚C

Auto Ignition Temperature: > 250˚C

General Information As in any fire, wear a self-contained breathing apparatus in pressure demand, MSHA/NIOSH (approved or equivalent), and full protective gear.

Suitable Extinguishing Media
Water fog or fine spray. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam. Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective.

Extinguish media, which shall not be used for safety reasons
Do not use direct water stream. May spread fire

Special exposure hazards in a fire:
During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. Combustion products may include and are not limited to: Carbon monoxide. Carbon dioxide. Container may rupture from gas generation in a fire situation. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids.

Special protective equipment for fire fighters:
Keep people away. Isolate fire and deny unnecessary entry. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed. Fight fire from protected location or safe distance. Consider the use of unmanned hose holders or monitor nozzles. Immediately withdraw all personnel from the area in case of rising sound from venting safety device or discoloration of the container. Burning liquids may be extinguished by dilution with water. Do not use direct water stream. May spread fire. Move container from fire area if this is possible without hazard. Burning liquids may be moved by flushing with water to protect personnel and minimize property damage.

Other instructions: On leakage it becomes slippery

Section 6: Accidental Release Measures

Personal Precautions: Wear protective clothing as described in Section 8 of this safety data sheet.

Environmental Precautions: Do not allow to enter drains, sewers or watercourses.

Small Spill: Remove all ignition sources. Clean up all spills immediately. Avoid breathing vapours and contact with skin and eyes. Control personal contact with the substance, by using protective equipment. Contain and absorp spill with sand, earth, inert material or vermiculite.

Large Spill: Clear area of personnel and move upwind. Alert Fire Brigade and tell them location and nature of hazard. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or water course.

Section 7: Handling and Storage

Precautions: Do not ingest. Do not breathe vapours/spray. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Avoid reaction with oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Exposure limit values:
Not applicable
Exposure controls:
Occupational exposure controls:
Use in a well-ventilated area. Local exhaust ventilation should be used in areas without good cross ventilation.
Respiratory protection
On exposure wear a NIOSH certified. European Standard EN 149 or equivalent respirator when using this product.
Hand protection
Protective gloves (Europe EN374, US F739)
Eye protection
Safety goggles (European standard – EN 166)
Skin protection
Normal clothes
General protective measures
Avoid contact with skin and eyes, do not inhale vapour
Environmental exposure controls
Not any

Section 9: Physical and Chemical Properties

Physical state and appearance: Pale yellow liquid

Odor: Ammonical

pH (5%): >10.0

Flash Point: >150 ˚C

Boiling Point: >100˚C

Auto-Ignition Temperature: >250˚C

Specific Gravity : 1.15

Relative density: Not available.

Critical Temperature: Not available.

Vapor Pressure: Not applicable.

Volatility: Not available.

Odor Threshold: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Miscible in water

Section 10: Stability and Reactivity Data

Reactivity: Will not polymerize.

Chemical stability: Stable at typical use temperature (max 100 ˚C)

Materials to avoid: Avoid contact with: Strong acids, strong oxidizers.

Conditions to avoid: Do not distill to dryness. Product can oxidize at elevated temperatures.

Hazardous decomposition products: Decomposition products depend upon temperature, air supply and the presence of other materials. Toxic gases are released during decomposition. Emits carbon oxides and nitrogen oxides when heated to decomposition.

Section 11: Toxicological Information

Acute Toxicity

Inhalation

Harmful if inhaled. May cause respiratory irritation. May cause central nervous system depression including headache, dizziness, drowsiness, incoordination, slowed reaction time, slurred speech, giddiness and unconsciousness.
LD50 (oral,rat) = 2,900 mg/kg
LD50 (dermal, rabbit) = 1,840 mg/kg

Eye Contact

Causes serious eye damage

Skin Contact: Causes skin irritation. May be absorbed through the skin and contribute to the symptoms listed under ingestion.

Ingestion: Low toxicity if swallowed. Small amounts swallowed incidentally as a result of normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury. Swallowing may result in gastrointestinal irritation or ulceration.

Chronic Effects/Carcinogenicity: No component of this product present at level greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen.

Section 12: Ecological Information

Ecotoxicity and aquatoxicity:
Acute for fish:
Poecilia reticulata: LC50 (96 h) > 100 mg/l
Longterm for fish: NOEC > 100 mg/l
Acute for invertebrates: Daphnia magna: EC50 (48 h) = 62.6 mg/l Longterm for invertebrates: no data available
Effective concentration for algae: EC50 (72 h) > 77.7 mg/l
Algae: ErC10 (72 h) = 0.4 mg/l
Summary for classification: Not classified

Biodegradibility: Biodegradable

Mobility: Potential for mobility in soil is very high (Koc between 0 and 50)

Bioaccumulative potential: BCF < 50

Other adverse effects: This substance is not on the Montreal Protocol list of substances that deplete the ozone layer.

Section 13: Disposal Considerations

Disposal Method
Disposal should be made in accordance with federal, state, and local regulations. Incineration recommended in approved incinerator according to federal, state, and local regulations. Substance should not be deposited into a sewage facility.

Packaging Disposal
Follow all applicable national or local regulations. Contaminated packaging may be disposed of by rendering packaging incapable of containing any substance, or treating packaging to remove residual contents, or treating packaging to make sure the residual contents are no longer hazardous, or by disposing of packaging into commercial waste collection.

Regulatory Disposal Information
RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrositivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning
Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAYEXPLODE AND CAUSE INJURY OR DEATH.

Section 14: Transport Information

IMDG/IMO	: Corrosive Liquid
UN Number	: 2735
UN Proper Shipping Name	: Amines, Liquid, Corrosive
Transport Hazard Class(es)	: 8
Packing Group	: III
Environmental Hazard	: Not applicable
NZ 5433.1999	: Corrosive Liquid
UN Number	: 2735
UN Proper Shipping Name	: Amines, Liquid, Corrosive
Transport Hazard Class(es)	: 8
Packing Group	: III
IATA/ICAO	: Corrosive Liquid
UN Number	: 2735
UN Proper Shipping Name	: Amines, Liquid, Corrosive
Transport Hazard Class(es)	: 8
Packing Group	: III
Special Precautions for User	: Not applicable
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	: Not applicable

Section 15: Regulatory Information

Other Label Information :

EU regulations concerning safety, health and environmental specific for the substance or mixture, as amended:

Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006;

Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC; Directive

2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives; Council Directive 96/82/EC on the control of major-accident hazards involving dangerous substances.

Legislation and regulations :

Dangerous Substance Directive 67/548/EEC. The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 (S.I 2009 No. 716). The List of Wastes (England) (Amendment) Regulations 2005. (SI 2005 No.895). Avfallsförordningen (2011:927).

Section 16: Other Information

Other Special Considerations: Not available.

Last Updated: 19/06/2023

GENERAL INFORMATION	
HMIS HEALTH	2
HMIS Flammability	1
HMIS Physical Hazard	0



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SAFETY DATA SHEET

PREMIUM GEL® NT

Section 1. Identification

Product identifier : PREMIUM GEL® NT

Product code : N/A

ADG : N/A

Product type : Solid

Identified uses : No information available

Importer's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Manufacturer's details : **AMERICAN COLLOID COMPANY**
2870 Forbs Avenue
Hoffman Estates
IL 60192
United States
Tel: +1-800-426-5564

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: +(81)-345209637 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 09 801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)
* Number can only be dialled in-country

Date of cover page : 28 May 2026
Date of supplier's SDS : 15 March 2021

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SAFETY DATA SHEET

1. Identification

Product identifier **PREMIUM GEL® NT**

Other means of identification

CAS number 1302-78-9

Synonyms SMECTITE CLAY

Recommended use Not available.

Recommended restrictions Workers (and your customers or users in the case of resale) should be informed of the potential presence of respirable dust and respirable crystalline silica as well as their potential hazards. Appropriate training in the proper use and handling of this material should be provided as required under applicable regulations.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company name American Colloid Company

Address 2870 Forbs Avenue
Hoffman Estates, IL 60192
United States

Telephone General Information 800 426 5564

Website www.colloid.com

E-mail safetydata@mineralstech.com

Emergency phone number +1 215 207 0061

Americas +1 215 207 0061

2. Hazard(s) identification

Physical hazards Not classified.

Health hazards

Carcinogenicity	Category 1A
Specific target organ toxicity, repeated exposure	Category 1

Environmental hazards Not classified.

OSHA defined hazards Not classified.

Label elements



Signal word Danger

Hazard statement May cause cancer. Causes damage to organs through prolonged or repeated exposure.

Precautionary statement

Prevention Do not handle until all safety precautions have been read and understood. Do not breathe dust. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Wear protective gloves/protective clothing/eye protection/face protection.

Response If exposed or concerned: Get medical advice/attention. Take off contaminated clothing and wash it before reuse.

Storage Store away from incompatible materials.

Disposal Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazard(s) not otherwise classified (HNOC) Material can be slippery when wet

Supplemental information 90% of the substance consists of component(s) of unknown acute oral toxicity. 100% of the substance consists of component(s) of unknown acute dermal toxicity. 100% of the substance consists of component(s) of unknown acute inhalation toxicity. 100% of the substance consists of component(s) of unknown acute hazards to the aquatic environment.

3. Composition/information on ingredients

Substances

Constituents

Chemical name	Common name and synonyms	CAS number	%
QUARTZ	CRYSTALLINE SILICA, QUARTZ SILICA (QUARTZ)	14808-60-7	<= 6
CRISTOBALITE		14464-46-1	<= 2

*Designates that a specific chemical identity and/or percentage of composition has been withheld as a trade secret.

Composition comments Occupational Exposure Limits for constituents are listed in Section 8.

4. First-aid measures

Inhalation Move to fresh air. Call a physician if symptoms develop or persist.

Skin contact Wash off with soap and water. Get medical attention if irritation develops and persists.

Eye contact Do not rub eyes. Rinse with water. Get medical attention if irritation develops and persists.

Ingestion Rinse mouth. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed Dusts may irritate the respiratory tract, skin and eyes. Prolonged exposure may cause chronic effects.

Indication of immediate medical attention and special treatment needed Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.

General information IF exposed or concerned: Get medical advice/attention. If you feel unwell, seek medical advice (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media Use any media suitable for the surrounding fires.

Unsuitable extinguishing media Not applicable, non-combustible.

Specific hazards arising from the chemical During fire, gases hazardous to health may be formed.

Special protective equipment and precautions for firefighters Material can be slippery when wet. Firefighters should wear full protective gear.

Fire fighting equipment/instructions Move containers from fire area if you can do so without risk.

Specific methods Use standard firefighting procedures and consider the hazards of other involved materials.

General fire hazards This material will not burn. Material can be slippery when wet No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Material can be slippery when wet. Wear appropriate protective equipment and clothing during clean-up. Do not breathe dust. Wear a dust mask if dust is generated above exposure limits. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air). Collect dust using a vacuum cleaner equipped with HEPA filter. Stop the flow of material, if this is without risk.

Large Spills: Wet down with water and dike for later disposal. Shovel the material into waste container. Following product recovery, flush area with water.

Small Spills: Sweep up or vacuum up spillage and collect in suitable container for disposal.

Never return spills to original containers for re-use. Put material in suitable, covered, labeled containers. For waste disposal, see section 13 of the SDS.

Environmental precautions Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling

Do not handle until all safety precautions have been read and understood. Minimize dust generation and accumulation. Provide appropriate exhaust ventilation at places where dust is formed. When using, do not eat, drink or smoke. Should be handled in closed systems, if possible. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Observe good industrial hygiene practices.

Conditions for safe storage, including any incompatibilities

Store in tightly closed container. Store in a well-ventilated place. Keep out of the reach of children. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Constituents	Type	Value	Form
CRISTOBALITE (CAS 14464-46-1)	PEL	0.05 mg/m3	Respirable dust.
QUARTZ (CAS 14808-60-7)	PEL	0.05 mg/m3	Respirable dust.

US. OSHA Table Z-3 (29 CFR 1910.1000)

Constituents	Type	Value	Form
INERT OR NUISANCE DUSTS (CAS SEQ250)	TWA	5 mg/m3	Respirable fraction.
		15 mg/m3	Total dust.
		50 mppcf	Total dust.
		15 mppcf	Respirable fraction.
CRISTOBALITE (CAS 14464-46-1)	TWA	0.05 mg/m3	Respirable.
		1.2 mppcf	Respirable.
QUARTZ (CAS 14808-60-7)	TWA	0.05 mg/m3	Respirable.
		2.4 mppcf	Respirable.

US. ACGIH Threshold Limit Values

Constituents	Type	Value	Form
CRISTOBALITE (CAS 14464-46-1)	TWA	0.025 mg/m3	Respirable fraction.
QUARTZ (CAS 14808-60-7)	TWA	0.025 mg/m3	Respirable fraction.

US. NIOSH: Pocket Guide to Chemical Hazards

Constituents	Type	Value	Form
CRISTOBALITE (CAS 14464-46-1)	TWA	0.05 mg/m3	Respirable dust.
QUARTZ (CAS 14808-60-7)	TWA	0.05 mg/m3	Respirable dust.

Biological limit values

No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls

Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. If material is ground, cut, or used in any operation which may generate dusts, use appropriate local exhaust ventilation to keep exposures below the recommended exposure limits.

Individual protection measures, such as personal protective equipment

Eye/face protection

Applicable for industrial settings only. If contact is likely, safety glasses with side shields are recommended.

Skin protection

Hand protection

Applicable for industrial settings only. Suitable gloves can be recommended by the glove supplier.

Other

Applicable for industrial settings only. Use of protective coveralls and long sleeves is recommended.

Respiratory protection

Applicable for industrial settings only. In case of inadequate ventilation, use respiratory protection.

Thermal hazards

Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations	Observe any medical surveillance requirements. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	Lump, granular or fine powder.
Physical state	Solid.
Form	Powder. Various.
Color	Various.
Odor	None.
Odor threshold	Not applicable.
pH	8.5 - 11
Melting point/freezing point	> 842 °F (> 450 °C) / Not applicable.
Initial boiling point and boiling range	Not applicable.
Flash point	Not applicable.
Evaporation rate	Not applicable.
Flammability (solid, gas)	This product is not flammable.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not applicable.
Flammability limit - lower (%) temperature	Not applicable.
Flammability limit - upper (%)	Not applicable.
Flammability limit - upper (%) temperature	Not applicable.
Explosive limit - lower (%)	Not applicable.
Explosive limit - lower (%) temperature	Not applicable.
Explosive limit - upper (%)	Not applicable.
Explosive limit - upper (%) temperature	Not applicable.
Vapor pressure	Not applicable.
Vapor density	Not applicable.
Relative density	2.6 g/cm³
Solubility(ies)	
Solubility (water)	< 0.9 mg/l
Partition coefficient (n-octanol/water)	Not applicable.
Auto-ignition temperature	Not applicable.
Decomposition temperature	> 932 °F (> 500 °C)
Viscosity	Not applicable.
Viscosity temperature	Not applicable.
Other information	
Bulk density	0.9 - 1.4 g/cm³
Explosive limit	Not applicable.
Explosive properties	Not explosive. Not explosive
Explosivity	Not applicable.
Fire point	Not applicable.
Flame extension	Not applicable.
Flame projection	Not applicable.
Flammability	Not applicable.

Flammability (flash back)	Not applicable.
Flammability (Heat of combustion)	Not applicable.
Flammability (Train fire)	Not applicable.
Flammability class	Not applicable.
Flash point class	Not flammable
Molecular formula	UVCB Substance
Molecular weight	Not applicable.
Oxidizing properties	Not oxidizing. None.
Percent volatile	0 %
pH in aqueous solution	8.5 - 11
Specific gravity	Not applicable.
VOC	0 % CARB

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. Avoid temperatures exceeding the decomposition temperature. Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	May cause damage to organs through prolonged or repeated exposure by inhalation. Dust may irritate respiratory system.
Skin contact	Dust or powder may irritate the skin.
Eye contact	Dust may irritate the eyes.
Ingestion	Expected to be a low ingestion hazard.
Symptoms related to the physical, chemical and toxicological characteristics	Dusts may irritate the respiratory tract, skin and eyes.

Information on toxicological effects

Acute toxicity Not known.

Toxicological data

Constituents	Species	Test Results
CRISTOBALITE (CAS 14464-46-1)		
Acute		
Oral		
LD50	Rat	> 22500 mg/kg
QUARTZ (CAS 14808-60-7)		
Acute		
Oral		
LD50	Rat	500 mg/kg

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization

Respiratory sensitization Not a respiratory sensitizer.

Skin sensitization This product is not expected to cause skin sensitization.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity In June 2003, SCOEL (the EU Scientific Committee on Occupational Exposure Limits) concluded that the main effect in humans of the inhalation of respirable crystalline silica dust is silicosis. "There is sufficient information to conclude that the relative risk of lung cancer is increased in persons with silicosis (and, apparently, not in employees without silicosis exposed to silica dust in quarries and in the ceramic industry). Therefore, preventing the onset of silicosis will also reduce the cancer risk..." (SCOEL SUM Doc 94-final, June 2003) According to the current state of the art, worker protection against silicosis can be consistently assured by respecting the existing regulatory occupational exposure limits. May cause cancer. Occupational exposure to respirable dust and respirable crystalline silica should be monitored and controlled.

IARC Monographs. Overall Evaluation of Carcinogenicity

CRISTOBALITE (CAS 14464-46-1)	1 Carcinogenic to humans.
QUARTZ (CAS 14808-60-7)	1 Carcinogenic to humans.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

CRISTOBALITE (CAS 14464-46-1)	Cancer

US. National Toxicology Program (NTP) Report on Carcinogens

CRISTOBALITE (CAS 14464-46-1)	Known To Be Human Carcinogen. Reasonably Anticipated to be a Human Carcinogen.
QUARTZ (CAS 14808-60-7)	Known To Be Human Carcinogen.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure Not classified.

Specific target organ toxicity - repeated exposure Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard Not an aspiration hazard.

Chronic effects Causes damage to organs through prolonged or repeated exposure.

12. Ecological information

Ecotoxicity The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Product		Species	Test Results
ACCOFLOC® SDG (CAS 1302-78-9)			
Aquatic			
Acute			
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	19000 mg/l, 96 hours

* Estimates for product may be based on additional component data not shown.

Persistence and degradability No data is available on the degradability of this product.

Bioaccumulative potential No data available.

Mobility in soil No data available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of contents/container in accordance with local/regional/national/international regulations.

Local disposal regulations Dispose in accordance with all applicable regulations.

Hazardous waste code The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Toxic Substances Control Act (TSCA)

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

CRISTOBALITE (CAS 14464-46-1)	Cancer lung effects immune system effects kidney effects

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical No (Exempt)

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

Food and Drug Administration (FDA) Total food additive
Direct food additive
GRAS food additive

US state regulations

California Proposition 65



WARNING: WARNING: This product contains a chemical known to the State of California to cause cancer. This product can expose you to QUARTZ, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

California Proposition 65 - CRT: Listed date/Carcinogenic substance

QUARTZ (CAS 14808-60-7) Listed: October 1, 1988

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

CRISTOBALITE (CAS 14464-46-1)

QUARTZ (CAS 14808-60-7)

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Chemical Substance Inventory (TCSI)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 15-March-2021

Revision date 15-March-2021

Version # 20

HMIS® ratings Health: 3*
Flammability: 0
Physical hazard: 0

NFPA ratings Health: 2
Flammability: 0
Instability: 0

Disclaimer American Colloid Company cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The information in the sheet was written based on the best knowledge and experience currently available. The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The manufacturer expressly does not make any representations, warranties, or guarantees as to its accuracy, reliability or completeness nor assumes any liability, for its use. It is the user's responsibility to verify the suitability and completeness of such information for each particular use.

The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process,

Revision information Product and Company Identification: Alternate Trade Names
Hazard(s) identification: Prevention
Handling and storage: Precautions for safe handling
Toxicological Information: Toxicological Data

SAFETY DATA SHEET

MN-MMO

Section 1. Identification

Product identifier	:	MN-MMO
Product code	:	N/A
ADG	:	N/A
Product type	:	Solid
Identified uses	:	Bentonite extender
Importer's details	:	Baker Hughes, Australia 631 Karel Avenue, Jandakot, Western Australia 6164, Australia Tel: 08 6595 7100
Manufacturer's details	:	**MN DRILLCHEM** **D.No.: 7/455-B-10** **1st Floor** **New Krishna Nagar** **Railway Kodur Andhra Pradesh** **India** **Tel: (+91) 77382 38124**
Emergency telephone number	:	CHEMTREC Emergency Telephone Numbers (Asia Pacific Region): - Australia: (02) 9037 2994 - Brunei: +(65)-31581349 (Mandarin/English) - China: 4001-204937 (Mandarin) * - Hong Kong: 800-968-793 (Cantonese) * - Indonesia: 001-803-017-9114 (Bahasa Indonesian) * - Japan: +(81)-345209637 (Japanese) - Malaysia: 1-800-815-308 (Bahasa Malay) * - New Zealand: 09 801 0034 - Philippines: 1-800-1-116-1020 (Tagalog) * - PNG: +(61) 2 9037 2994 - Singapore: 800-101-2201 (Mandarin) * - South Korea: 00-308-13-2549 (Korean) * - Taiwan: 00801-14-8954 (Mandarin) * - Thailand: 001-800-13-203-9987 (Thai) * - Vietnam: +(84)-838012436 (Vietnamese) - UK: +(44) 870-820-0418 - USA: +(1) 703-527-3887 (CHEMTREC International 24 hour) * Number can only be dialled in-country
Date of cover page	:	3 March 2025
Date of supplier's SDS	:	11 December 2023

This is a Baker Hughes cover page for our Supplier's SDS. A copy of this SDS has been provided to CHEMTREC

SAFETY DATA SHEET

Doc. Number	MN-SDS-032
Version	1
Date	12/1/2024

MN-MMO

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

1.1 Product identifier

Product Name	**MN-MMO**
Synonyms	MIXED METAL OXIDE
Product ID	MN032

1.2 Uses

Uses	BENTONITE EXTENDER

1.3 Details of the supplier of the product

Manufacturer & Supplier name	**MN DRILLCHEM**
Address	D.No.: 7/455-B-10, 1st Floor , New Krishna Nagar Railway Kodur Andhra Pradesh, India
Telephone	(+91) 77382 38124
Email	sales@mndrillingchemicals.com
Website	www.mndrillingchemicals.com

2. HAZARDS IDENTIFICATION

Hazardous according to the criteria of the 3rd Revised Edition of the Globally Harmonised System of Classification and Labelling of Chemicals (GHS),
Non-Dangerous Goods according to the criteria of ADG.

Classification of the substance or mixture

Powder

Hazard and Precautionary Statements

Not applicable

Signal word:	Warning
Hazard Statement:	Causes serious eye irritation
Precautionary Statements:	Wear eye protection, wash contaminated body parts thoroughly after handling

Contains

Substances	**CAS No.**
Sodium Carbonate	497-19-8

Additional Information: No information available

Other Hazards This subtance is not consider to be persistent, bioaccumalating not toxic.

3. COMPOSITION/ INFORMATION ON INGREDIENTS

3.1 Substances / Mixtures

Ingredients	CAS No.	Contents
Sodium carbonate	497-19-8	20-50%

4. FIRST AID MEASURES

Description of first aid measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Skin Wash with soap and water. Get medical attention if irritation persists.

Ingestion Under normal conditions, first aid procedures are not required.

Notes to physician Treat symptomatically.

5. FIRE FIGHTING MEASURES

Extinguishing media

Suitable Extinguishing Media

dry powder, foam, carbon dioxide

Extinguishing media which must not be used for safety reasons

Water jet

Specific hazards arising from the chemical

Special exposure hazards in a fire

nitrogen oxide, carbon dioxide, harmful vapours, Evolution of fumes/fog, do not breath gas vapour

Advice for firefighters

Special protective equipment for firefighters

Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Avoid dust formation, use personal protective clothing, Ensure adequate ventilation.

Environmental precautions

Contain contaminated water/firefighting water, do not discharge into drains/surface water/ground water.

Procedure for Cleaning/Absorption

For Small amount: Pickup with suitable appliances and dispose of.

For Large amounts: Contain with dust binding materials and dispose of. Avoid raising dust.

Reference to other sections

See Section 8 and 13 for additional information.

7. HANDLING AND STORAGE

Precautions for safe handling

Breathing must be protected when large quantities are decanted without local exhaust ventilation. Avoid inhalation of dusts. Avoid contact with the skin, eyes and clothing. Use suitable eye protection. No eating, drinking, smoking or tobacco use at the place of work. Hands and/or face should be washed before breaks and at the end of the shift. Remove contaminated clothing and protective equipment before entering eating areas.

Storage Information

Segregate from acids. Segregate from foods and animal feeds.

Further information on storage conditions: Keep container tightly closed and dry. Protect from wetness

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Controls	Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.
Respiratory Protection	Breathing protection if dusts are formed. Particle filter with medium efficiency for solid and liquid particles
Hand Protection	Chemical resistant protective gloves
Skin Protection	Body protection must be chosen depending on activity and possible exposure, e.g. apron, protecting boots, chemical-protection suit
Eye Protection	Safety glasses with side-shields
Other Precautions	None known.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Solid
Color	White to off white
Odor	Odorless
pH	Approx 11
Melting point/freezing point	Not Available
Initial Boiling Point	Not Available
Boiling point, initial boiling	Not Available
Flash point	Not applicable
Evaporation rate	Not Available
Flammability	Not Available
Vapor pressure	Not Available
Relative vapor density	Not applicable
Relative density	1.9-2.2
Specific Gravity	2.2 - 2.6 g/cm3
Solubility in water	Practically Insouluble
Auto-ignition temperature	Not applicable
Decomposition temperature	Not Available
Viscosity	Not Available
Pour Point	Not Available

10. STABILITY AND REACTIVITY

Stability Data:

Stable

Hazardous Polymerization:

Will Not Occur

Conditions to Avoid

None anticipated

Incompatibility (Materials to Avoid)

Acids

Hazardous Decomposition Products

carbon dioxide

Additional Guidelines

Not Applicable

11. TOXICOLOGICAL INFORMATION

Ingredients		CAS No.	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sodium Carbonate		497-19-8	> 5000 mg/kg (Rat),	No Data Available	-

Principle Route of Exposure Eye or skin contact, inhalation.

Inhalation Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A).

Eye Contact May cause mechanical irritation to eye.

Skin Contact May cause mechanical skin irritation.

Ingestion None known

Chronic Effects/Carcinogenicity Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis.

12. ECOLOGICAL INFORMATION

Toxicity

No known significant effects or critical hazards.

Persistance and degradibility

Not Available

13. DISPOSAL CONSIDERATIONS

Safe handling and disposal methods

Follow all applicable community, national or regional regulations regarding waste management methods.

Disposal of any contaminated packaging

Follow all applicable national or local regulations. Contaminated packaging may be disposed of by: rendering packaging incapable of containing any substance, or treating packaging to remove residual contents, or treating packaging to make sure the residual are no longer hazardous, or by disposing of packaging into commercial waste collection.

Environmental regulations

Not applicable

14. TRANSPORT INFORMATION

Transportation Information

Australia ADG

UN Number	Not restricted
UN proper shipping name	Not restricted
Transport Hazard Class(es)	Not applicable
Packing Group	Not applicable
Environmental Hazards	Not applicable

IMDG/IMO

UN Number	Not restricted
UN proper shipping name	Not restricted
Transport Hazard Class(es)	Not applicable
Packing Group	Not applicable
Environmental Hazard	Not applicable

IATA/ICAO

UN Number	Not restricted
UN proper shipping name	Not restricted
Transport Hazard Class(es)	Not applicable
Packing Group	Not applicable
Environmental Hazard	Not applicable

HazChem Code

None Allocated

15. REGULATORY INFORMATION

Safety, health and environmental regulations specific for the product

Australian AICS Inventory	All components are listed on the AICS or are subject to a relevant exemption, permit, or assessment certificate.
New Zealand Inventory of Chemicals	All components are listed on the NZIoC or are subject to a relevant exemption, permit, or assessment certificate.
US TSCA Inventory	All components listed on inventory or are exempt.

Canadian Domestic Substances List (DSL)	All components listed on inventory or are exempt.
Poisons Schedule number	None Allocated
International Agreements	Does not apply

16. OTHER INFORMATION

Revision Date	11Dec23
Additional information	For additional information on the use of this product, contact

Abbreviations

bw–bodyweight
CAS–ChemicalAbstractsService
EC50–EfectiveConcentration50%
LC50–LethalConcentration50%
LD50–LethalDose50%
LL50–LethalLoading50%
mg/kg–miligram/kilogram
mg/L–miligram/liter
NOEC-No Observed Efect Concentration
OEL-Occupational Exposure Limit
PBT-Persistent Bioacumulative and Toxic
ppm-parts per million
STEL-Short Term Exposure Limit
TWA-Time Weighted Average
vPvB-very Persistent and very Bioacumulative
h-hour
mg/m3-milligram/cubic meter
mm-millimeter
mmHg-millimeter mercury
w/w-weight/weight
d-day

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MN Drillchem

SAFETY DATA SHEET

Doc. Number	MN-SDS-032
Version	1
Date	12/1/2024

MN-MMO

[End of SDS]

SAFETY DATA SHEET

NX LUBE DR+

Section 1. Identification

Product identifier : NX LUBE DR+

Product code : N/A

ADG : N/A

Product type : Liquid

Identified uses : Industrial use

Importer's details :
Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Manufacturer's details :
NEXUSCHEM ENGINEERING SDN BHD
No 2, Lorong Sultan Mohamed 25E/KU18
Taman Perindustrian Bandar Sultan Suleiman
42000 Pelabuhan Klang
Selangor
Malaysia
Tel: +60356353223

Emergency telephone number :
CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: +(81)-345209637 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 09 801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
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- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

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Date of cover page : 7 February 2025
Date of supplier's SDS : 18 January 2023

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MATERIAL SAFETY DATA SHEET
NX LUBE DR+

Revision Date: 18/01/2023 Version: 1.0

SECTION 1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Information
Product Name: NX LUBE DR+

Recommended use of the chemical and restrictions on use
Recommended use: Industrial use
Restrictions on use: No information available

Company Identification
Company Name: Nexuschem Engineering Sdn Bhd
Address: No 2, Lorong Sultan Mohamed 25E/KU18,
Taman Perindustrian Bandar Sultan Suleiman,
42000 Klang, Selangor, Malaysia.
Email: ian.ong@nexus-venture.com
Web: www.nexus-venture.com
Tel: +60356353223

Contact Point: POISON CENTRE MALAYSIA
1800 888 099 (office hours)

SECTION 2: HAZARDS IDENTIFICATION

Classification of the Substance or mixture
Classification according to Regulation (EC) No. 1272/2008 [CLP]
Not classified

Adverse physicochemical, human health and environmental effects
Not classified as dangerous according to the criteria of Australian NOHSC (not hazardous; not dangerous goods).
According to ABNT NBR 14725-2, no labelling obligation.

Label elements
Labelling according to Regulation (EC) No. 1272/2008 [CLP]
No labelling applicable

Other hazards
No additional information available

SECTION 3: COMPOSITION/ INFORMATION ON INGREDIENTS

Mixtures

Mixture	CAS No	% (weight)
Fatty acid ester of polyalcohol, polyoxyethylene fatty acid ester, mixed fatty acid	85049-33-8, 9005-65-6, 67701-06-8	100

SECTION 4: FIRST AID MEASURES

Description of first aid measures

General
If you feel unwell, seek medical advice.

After inhalation
Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

After skin contact	Rinse with water. Soap may be used. Take victim to a doctor if irritation persists.
After eye contact	Rinse with water. Take victim to an ophthalmologist if irritation persists.
After ingestion	Rinse mouth with water. Call Poison Information Centre. Consult a doctor/medical service if you feel unwell.
Most important symptoms and effects, both acute and delayed	Unlikely to cause harmful effects.
Indication of any immediate medical attention and special treatment needed	No supplementary information available.

SECTION 5: FIRE-FIGHTING MEASURES

Suitable extinguishing media	AFFF foam. BC powder. Carbon dioxide. Dry sand. Dry chemical powder. Adapt extinguishing media to the environment.
Unsuitable extinguishing media	Solid water jet ineffective as extinguishing medium.
Special hazards arising from the substrate or mixture	**Fire hazard** DIRECT FIRE HAZARD. Combustible. INDIRECT FIRE HAZARD. Heating increases the fire hazard. Temperature above flashpoint: higher fire/explosion hazard. **Explosion hazard** No direct explosion hazard. **Reactivity** On burning: release of (carbon monoxide - carbon dioxide).
Advice for firefighters	No supplementary information available.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	**General measures** Mark the danger area. Exposure to heat: have neighbourhood close doors and windows. Exposure to fire/heat: consider evacuation. Wash contaminated clothes. **For non-emergency personnel protective equipment** See "Material-Handling" to select protective clothing. **For emergency responders protective equipment** Use protective measures listed in Section 8.
Environmental precautions	Prevent soil and water pollution.
Methods and material for containment and cleaning up	Clean contaminated surfaces with an excess of water and soap solution.

Reference to other sections	Handle waste materials in accordance with the provisions of Section 13.

SECTION 7: HANDLING AND STORAGE

Precautions for safe handling

Smoking, eating and drinking should be prohibited in areas of storage and use.

Handling temperature: ≥ 10 °C above melting point

Hygiene measures: Wash hands before break and at end of works. Good standard of personal hygiene.

Conditions for safe storage, including any incompatibilities

Prohibitions on mixed storage
KEEP SUBSTANCE AWAY FROM: heat sources.

Storage area
Keep container in a well-ventilated place. Store at ambient temperature. Keep out of direct sunlight. Meet the legal requirements.

Special rules on packaging
SPECIAL REQUIREMENTS: closing. correctly labelled. meet the legal requirements.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Control parameters

No additional information available.

Exposure controls

Personal Protective Equipment

Gloves. Protective clothing. Safety glasses.



Materials for protective clothing

GIVE GOOD RESISTANCE: nitrile rubber.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Yellow to amber.
Physical state:	Liquid
Odour:	Characteristic odour – Sweet odour
pH:	No data available
Initial boiling point/boiling range (°C):	> 250
Melting point / freezing point (°C):	< -10
Flash point (°C):	> 200 (ASTM D92)
Solubility in water:	Soluble
Solubility in other ingredients:	Soluble in: alcohols, chloroform, ether
Vapour pressure (hPa):	No data available
Relative vapour density at 20°C:	No data available

Self ignition temperature (°C):	> 300
Decomposition temperature:	No data available
Density:	ca. 1003kg/m³ (20°C)
Kinematic viscosity at 40°C:	ca. 120mm²/s
Other properties:	Oily. Soluble in oils/fats. Soluble in most organic solvents. Insoluble in water

SECTION 10: STABILITY AND REACTIVITY

Reactivity	On burning: release of (carbon monoxide - carbon dioxide).
Chemical stability	Stable under normal conditions.
Possibility of hazardous reactions	No additional information available
Conditions to avoid	No supplementary information available.
Incompatible materials	No supplementary information available.
Hazardous decomposition products	No supplementary information available.

SECTION 11: TOXICOLOGICAL INFORMATION

Information on toxicological effects

LD50 oral rat	>5000mg/kg Non-toxic
ATE (oral)	Not available

SECTION 12: ECOLOGICAL INFORMATION

Toxicity

Ecology - general
According to literature: no environmental hazard.

Ecology - air
No supplementary information available.

Ecology - water
No bioaccumulation data available

SECTION 13: DISPOSAL CONSIDERATIONS

Waste treatment methods Dispose of according to local, state and federal regulations.

SECTION 14: TRANSPORT INFORMATION

In accordance with ADR / RID / IMDG / IATA / AND

UN number	Not applicable No dangerous good in sense of transport regulations (including Australian DG Code)
UN proper shipping name	Not applicable
Transport hazard class(es)	Not applicable

Packing group	Not applicable
Environmental hazards	No
Transport in bulk according to Annex of MARPOL 73/78 and the IBC Code	No

SECTION 15: REGULATORY INFORMATION

Safety, health and environmental regulations / legislation specific for the substance or mixture
No additional information available

Chemical safety assessment
No additional information available

SECTION 16: OTHER INFORMATION

Issue date	18 January 2023
Revision date	18 January 2023
Version No.	1.0

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is to the best of our knowledge and believed accurate and reliable as of the date indicated. However, no representation, warranty or guarantee is made as to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for his own particular use.

SAFETY DATA SHEET

OVA COL 110 LC

Section 1. Identification

Product identifier	:	OVA COL 110 LC
Product code	:	OVA COL 110 LC
ADG	:	-
Product type	:	Liquid
Identified uses	:	Shale Control Additive
Importer's details	:	Baker Hughes, Australia 631 Karel Avenue, Jandakot, Western Australia 6164, Australia Tel: 08 6595 7100
Manufacturer's details	:	OVA CHEM SDN. BHD. A Barium Selat Company No 6-G, Jalan Tasik Utama 7, Medan Niaga Tasik Damai, 57000 Sungai Besi, Kuala Lumpur. Tel/Fax: +603 9054 1203
Emergency telephone number	:	CHEMTREC Emergency Telephone Numbers (Asia Pacific Region): - Australia: (02) 9037 2994 - Brunei: +(65)-31581349 (Mandarin/English) - China: 4001-204937 (Mandarin) * - Hong Kong: 800-968-793 (Cantonese) * - Indonesia: 001-803-017-9114 (Bahasa Indonesian) * - Japan: +(81)-345209637 (Japanese) - Malaysia: 1-800-815-308 (Bahasa Malay) * - New Zealand: 09 801 0034 - Philippines: 1-800-1-116-1020 (Tagalog) * - PNG: +(61) 2 9037 2994 - Singapore: 800-101-2201 (Mandarin) * - South Korea: 00-308-13-2549 (Korean) * - Taiwan: 00801-14-8954 (Mandarin) * - Thailand: 001-800-13-203-9987 (Thai) * - Vietnam: +(84)-838012436 (Vietnamese) - UK: +(44) 870-820-0418 - USA: +(1) 703-527-3887 (CHEMTREC International 24 hour) * Number can only be dialled in-country
Date	:	29 August 2023

This is a Baker Hughes cover page for our Supplier's SDS. A copy of this SDS has been provided to CHEMTREC

OVACHEM
Tomorrow's Chemistry Today

a Barium Selat Company

Safety Data Sheet
OVA COL 110 LC

Section 1: Chemical Product and Company Identification

Product Name: OVA COL 110 LC

CAS#: 9004-77-7

EC-No.: 500-012-0

TSCA: Not applicable.

CI#: Not applicable.

Synonym: Not applicable.

Chemical Name: Polyethylene glycol

Chemical Formula: Not available

Contact Information:

OVA CHEM SDN. BHD.
No 6-1, Jalan Tasik Utama 7
Medan Niaga Tasik Damai
57000 Sungai Besi, Kuala Lumpur.
Tel/Fax: +603 9054 1203

For emergency assistance, call: +6012 368 3559

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Glycol Ether	9004-77-7	100

Toxicological Data on Ingredients: Not available.

Section 3: Hazards Identification

GHS Label elements, including precautionary statements:

Pictogram



Signal Word Danger

Hazard statement(s)

H318	Causes serious eye damage
H302	Harmful if swallowed
H312	Harmful in contact with skin
H315	Causes skin irritation

Precautionary Measures and safe use
When handling this substance: wear protective gloves and/or clothing, and eye and/or face protection.

Section 4: First Aid Measures

Eye Contact:
In case of contact with eyes, rinse with plenty of water and contact Doctor of Poisons Information Centre.

Skin Contact:
If skin or hair contact occurs, flush skin and hair with running water (and soap if available) and seek medical attention in event of irritation.

Inhalation:
If inhaled, remove to fresh air. Keep person warm and at rest. If not breathing or breathing is difficult, provide artificial respiration and oxygen by trained personnel. Get medical attention if symptoms appear.

Ingestion:
Wash out mouth with water. Never give anything by mouth to an unconscious person. Get medical attention if symptoms appear.

Section 5: Fire and Explosion Data

Extinguishing media: If extinction, use dry chemical powder, foam, BCF (where regulation permit), carbon dioxide or water spray or fog if large fires extinction.

Special exposure hazard: Heating may cause expansion or decomposition leading to violent rupture of containers. Mists containing combustible materials may be explosive. Slight fire hazard when exposed to heat or flame.

Hazardous thermal decomposition products : Decomposition products may include the following materials: carbon dioxide, carbon monoxide, acrid smoke, other pyrolysis products typical of burning organic material, poisonous fumes and corrosive fumes.

Advice for fire-fighters: Fire-fighters should wear appropriate protective equipment.

Fire Incompatibility: Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Section 6: Accidental Release Measures

Personal precautions, protective equipment and emergency procedures:
Take note of any information in Section 8 on suitable and unsuitable materials, if specialized clothing is required to deal with the spillage.

Environmental precautions:
Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollutions.

Small spill:
Stop leak if without risk and move containers from spill area. If water soluble, dilute it with water. If absorb with an inert dry material, mop up. Place in an appropriate waste disposal container and dispose of via a licensed waste disposal contractor.

Large spill:
Stop leak if without risk and move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. earth, sand, vermiculite or diatomaceous earth and place in container for disposal according to local regulations and dispose of via a licensed waste disposal contractor.

Section 7: Handling and Storage

Precautions:
Do not eat, drink and smoke in areas where this material is handled, stored and processed. Wash hands and face after handled this material.
Storage:
Keep it in a dry, cool and well-ventilated area. Keep container tightly closed and sealed until ready for use.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
To minimize exposures, ensure adequate ventilation.
Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state (20˚C) and appearance: Pale yellow liquid

Odor: Faint

Substances type: Organic

Molecular Weight: not available

Kinematic Viscosity: 9.2 mm2/s

Boiling Point: 278 °C @ 101.325 kPa

Flash Point: 142 °C @ 101.325 kPa

Auto Ignition Temperature: 202 °C @ 101.325 kPa

Density: 0.989 g/cm³ @ 20 °C

Vapor Pressure: 0.069 - 0.333 Pa @ 25 °C

Partition Coeff.: Log Pow: 0.436 @ 25.5 °C and pH 6.6

Water Solubility: 989 g/L @ 20 °C and pH 7

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Reactivity: No specific data.

Instability Temperature: Not available.

Conditions to avoid: No specific data.

Incompatibility with various substances: No specific data.

Corrosivity: Not available.

Special Remarks on Corrosivity: Not available.

Section 11: Toxicological Information

Potential health effects

Ingestion	Harmful if swallowed
Skin	Harmful in contact with skin, causes skin irritation
Eyes	Causes serious eye damage and eye irritation

Toxicity to fish

LC50 (4 days) 1.8 g/L
LC50 (72 h) 1.8 g/L
LC50 (48 h) 1.8 g/L
LC0 (4 days) 1 g/L
LC0 (24 h) 1.8 g/L

Toxicity to aquatic invertebrates

EC50 (48 h) 3.2 g/L
EC50 (24 h) 3.2 g/L
LC50 (4 days) 1 g/L
NOEC (48 h) 1.8 g/L

Toxicity to aquatic algae and cyanobacteria

EC50 (72 h) 391 mg/L
EC10 (72 h) 188 mg/L

Section 12: Ecological Information

Hazard for Aquatic Organisms

Freshwater	4.5 mg/L
Intermittent releases (freshwater)	24.9 mg/L
Marine water	310 µg/L
Intermittent releases (marine water)	-
Sewage treatment plant (STP)	500 mg/L
Sediment (freshwater)	6.6 mg/kg sediment dw
Sediment (marine water)	660 µg/kg sediment dw

Biodegradation in water

Readily biodegradable (25%)

Section 13: Disposal Considerations

Waste Disposal:
The generation of waste should be avoided or minimized wherever possible. Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

	Land Transport (ADR/RID)	*Sea Transport (IMDG)*	*Air Transport (ICAO/IATA)*
UN-Number:	Not regulated	Not regulated	Not regulated
UN Proper shipping name:	Not regulated	Not regulated	Not regulated
Transport hazard class:	Not regulated	Not regulated	Not regulated
Packaging group:	Not regulated	Not regulated	Not regulated
Environmental hazards:	No	No	No
Special precautions for user:	See section 3	See section 3	See section 3
Transport in bulk according to Annex II of MARPOL and IBC code:	Not regulated	Not regulated	Not regulated

Section 15: Other Regulatory Information

EU Regulations: None of the components are listed.

Other EU Regulations: All components are exempted.

Chemical Safety Assessment:
This product contains substances for which Chemical Safety Assessments are still required.

Section 16: Other Information

Other Special Considerations: Not available.

Date updated: 22/8/2023

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall OVA Chem be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if OVA Chem has been advised of the possibility of such damages.

SAFETY DATA SHEET

Barite

Version 2

Section 1. Identification

Product identifier : Barite

Product code : 100316

ADG : -

Product type : Powder.

Identified uses : Cement additive

Supplier's details : Baker Hughes, Australia
108 Poole Street,
Welshpool,
Western Australia 6106,
Australia

Tel: +618 9350 3800
Fax: +618 9350 5453

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
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- PNG: +(61) 2 9037 2994
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- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : CARCINOGENICITY - Category 1
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2

GHS label elements

Hazard pictograms :



GHS08

Signal word : DANGER

Section 2. Hazard(s) identification

Hazard statements : H350 - May cause cancer.
H373 - May cause damage to organs through prolonged or repeated exposure. (lungs)

Precautionary statements

Prevention : Obtain special instructions before use. Wear protective gloves: > 8 hours (breakthrough time): nitrile or neoprene. Wear protective clothing. Wear eye or face protection. Wear hearing protection. Do not breathe dust or mist.

Response : IF exposed or concerned: Get medical advice or attention.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P201, P280, P260, P308 + P313, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
barium sulfate	60 - 100	7727-43-7
crystalline silica, respirable powder	1 - 5	14808-60-7
Mica-group minerals	1 - 5	12001-26-2

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : sulfur oxides,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe dust. Do not ingest. If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
barium sulfate	**Safe Work Australia (Australia, 10/2022).** TWA: 10 mg/m³ 8 hours.
crystalline silica, respirable powder	**Safe Work Australia (Australia, 1/2014).** TWA: 0.1 mg/m³ 8 hours. Form: Respirable dust
Mica-group minerals	**Safe Work Australia (Australia, 10/2022).** TWA: 2.5 mg/m³ 8 hours. Form: Inspirable

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): nitrile or neoprene

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: Wear a respirator conforming to EN140 with type A/P2 filter or better.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Tan. to Brown.

Odour : Odourless.

Odour threshold : Not available.

pH : 7 [Conc. (% w/w): 2% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : Non-flammable.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 4 to 4.5 (20°C)

Solubility(ies) :

Media	Result
cold water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Heating with aluminum may cause explosions.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
crystalline silica, respirable powder	LD50 Oral	Rat	>5000 mg/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Product/ingredient name	Category	Route of exposure	Target organs
crystalline silica, respirable powder	Category 1	inhalation	lungs

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Section 11. Toxicological information

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : May cause damage to organs through prolonged or repeated exposure. Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code -
ADG Class	No.	Hazchem code -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Section 15. Regulatory information

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 26 February 2024.

Date of issue/Date of revision : 26 February 2024

Date of previous issue : 10 March 2023

Version : 2

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
CARCINOGENICITY - Category 1 SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2	Calculation method Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : Bentonite

Product code : 100120

ADG : -

Product type : Powder.

Identified uses : Cement additive / Drilling Fluid Viscosifier

Supplier's details : Baker Hughes, Australia
108 Poole Street,
Welshpool,
Western Australia 6106,
Australia

Tel: +618 9350 3800
Fax: +618 9350 5453

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : CARCINOGENICITY - Category 1
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2

GHS label elements

Hazard pictograms :



GHS08

Signal word : DANGER

Section 2. Hazard(s) identification

Hazard statements : H350 - May cause cancer.
H373 - May cause damage to organs through prolonged or repeated exposure. (lungs)

Precautionary statements

Prevention : Obtain special instructions before use. Wear protective gloves: > 8 hours (breakthrough time): Nitrile or Neoprene gloves.. Wear protective clothing. Wear eye or face protection. Wear hearing protection. Do not breathe dust or mist.

Response : IF exposed or concerned: Get medical advice or attention.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P201, P280, P260, P308 + P313, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
Bentonite	60 - 100	1302-78-9
crystalline silica, respirable powder	5 - 10	14808-60-7

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe dust. Do not ingest. If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
crystalline silica, respirable powder	**Safe Work Australia (Australia, 1/2014).** TWA: 0.1 mg/m³ 8 hours. Form: Respirable dust

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): Nitrile or Neoprene gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: Wear a respirator conforming to EN140 with type A/P2 filter or better.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder./ Granules]

Colour : Grey.

Odour : Odourless.

Odour threshold : Not available.

pH : 8 to 10 [Conc. (% w/w): 5%]

Melting point/freezing point : 1450 to 1580°C

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 2.4 to 2.6

Solubility(ies) :

Media	Result
cold water	Not soluble
hot water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
crystalline silica, respirable powder	LD50 Oral	Rat	>5000 mg/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Product/ingredient name	Category	Route of exposure	Target organs
crystalline silica, respirable powder	Category 1	inhalation	lungs

Aspiration hazard

Not available.

Information on likely routes of exposure : Routes of entry anticipated: Inhalation.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Section 11. Toxicological information

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : May cause damage to organs through prolonged or repeated exposure. Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
Bentonite	Acute LC50 19000000 µg/l Fresh water	Fish - *Oncorhynchus mykiss*	96 hours

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Section 15. Regulatory information

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 26 February 2024.

Date of issue/Date of revision : 26 February 2024

Date of previous issue : 10 March 2023

Version : 2

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
CARCINOGENICITY - Category 1	Calculation method
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

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SAFETY DATA SHEET

BIO-PAQ™

Version 3

Section 1. Identification

Product identifier : BIO-PAQ™

Product code : 9101DF

Product type : Powder.

Identified uses : Filtration Control Agent

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Section 2. Hazard(s) identification

Disposal : Not applicable.

Precautionary statements (Code) : P103, P102, P101, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
Starch, carboxymethyl ether, sodium salt	60 - 100	9063-38-1

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Section 4. First aid measures

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid breathing dust. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Section 8. Exposure controls and personal protection

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): Nitrile or Neoprene gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Off-white.

Odour : Not available.

Odour threshold : Not available.

pH : 8.5 [Conc. (% w/w): 5% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 1.5

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Section 9. Physical and chemical properties and safety characteristics

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Reactive or incompatible with the following materials: oxidising materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Section 11. Toxicological information

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.		-	-	
ADG	Not regulated.		-	-	
IMDG	Not regulated.		-	-	
IATA	Not regulated.		-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	-
ADG Class	No.	-
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

Section 15. Regulatory information

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 20 February 2024

Date of previous issue : 20 December 2023

Version : 3

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

Section 16. Any other relevant information

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : BRINE-PAC™ XTS

Product code : 7233DF

ADG : ALCOHOLS, N.O.S. (2-methylbut-3-yn-2-ol)

Product type : Liquid.

Identified uses : Corrosion inhibitor.

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 3
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1

GHS label elements

Hazard pictograms :



GHS02 GHS05

Signal word : DANGER

Hazard statements : H226 - Flammable liquid and vapour.
H318 - Causes serious eye damage.

Section 2. Hazard(s) identification

Precautionary statements

Prevention : Wear eye or face protection: Recommended: Chemical splash goggles.. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Response : IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P280, P210, P305 + P351 + P338, P310, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
2-methylbut-3-yn-2-ol	≥75 - ≤90	115-19-5

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Chemical burns must be treated promptly by a physician.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Get medical attention immediately. Call a poison center or physician. Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, alcohol-resistant foam or water spray (fog).

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical : Flammable liquid and vapour. Runoff to sewer may create fire or explosion hazard. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : •3Y

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Do not breathe vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not get in eyes or on skin or clothing. Do not breathe vapour or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store in original container, protected from direct sunlight. Store locked up. Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid

Section 7. Handling and storage

environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): neoprene Gloves

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid. [Clear.]

Colour : Yellow. [Light]

Odour : Floral.

Odour threshold : Not available.

pH : 5

Melting point/freezing point : -16°C

Boiling point, initial boiling point, and boiling range : 103.9°C (219°F)

Flash point : Closed cup: 25°C (77°F)

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Vapour pressure : 1.9 kPa (14.02 mm Hg) at 21°C

Relative vapour density : Not available.

Relative density : 0.89

Solubility(ies) :

Media	Result
cold water hot water	Partially soluble Partially soluble

Miscible with water : Yes.

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
2-methylbut-3-yn-2-ol	LD50 Oral	Rat	1950 mg/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : Risk of serious damage to eyes. May cause eye burns and permanent eye injury.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Section 11. Toxicological information

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
2-methylbut-3-yn-2-ol	Acute LC50 3290000 µg/l Fresh water	Fish - *Pimephales promelas*	96 hours

Persistence and degradability

Not available.

Product/ingredient name	$LogP_{ow}$	BCF	Potential
2-methylbut-3-yn-2-ol	0.318	-	Low

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Vapour from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	UN1987	ALCOHOLS, N.O.S. (2-methylbut-3-yn-2-ol)	3	III	
ADG	UN1987	ALCOHOLS, N.O.S. (2-methylbut-3-yn-2-ol)	3	III	
IMDG	UN1987	ALCOHOLS, N.O.S. (2-methylbut-3-yn-2-ol)	3	III	
IATA	UN1987	ALCOHOLS, N.O.S. (2-methylbut-3-yn-2-ol)	3	III	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** 3Y
ADG Class	No.	**Hazchem code** •3Y
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

Section 15. Regulatory information

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 20 February 2024

Date of previous issue : 12 February 2024

Version : 2

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
FLAMMABLE LIQUIDS - Category 3 SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1	On basis of test data Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

Section 16. Any other relevant information

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : BRINE-PAC™ 1500A

Product code : 5039DF

ADG : AMINES, LIQUID, CORROSIVE, N.O.S. (contains alkylamine)

Product type : Liquid.

Identified uses : Corrosion inhibitor

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 4
SKIN CORROSION/IRRITATION - Category 1
SKIN SENSITISATION - Category 1

GHS label elements

Hazard pictograms :



GHS05 GHS07

Signal word : DANGER

Section 2. Hazard(s) identification

Hazard statements : H227 - Combustible liquid.
H314 - Causes severe skin burns and eye damage.
H317 - May cause an allergic skin reaction.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Prevention : Wear protective gloves, protective clothing and eye or face protection. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Avoid breathing vapour.

Response : IF INHALED: Immediately call a POISON CENTER or doctor. IF SWALLOWED: Immediately call a POISON CENTER or doctor. Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. Immediately call a POISON CENTER or doctor. Wash contaminated clothing before reuse. IF ON SKIN: Wash with plenty of water. If skin irritation or rash occurs: Get medical advice or attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor.

Storage : Store locked up.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : P103, P102, P101, P280, P210, P261, P304 + P310, P301 + P310, P330, P331, P303 + P361 + P353, P310, P363, P302 + P352, P333 + P313, P305 + P351 + P338, P310, P405, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
3,6-diazaoctanethylenediamin	≥10 - <25	112-24-3

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Chemical burns must be treated promptly by a physician.

Section 4. First aid measures

Inhalation : Call a poison center or physician. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Get medical attention immediately. Call a poison center or physician. Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Call a poison center or physician. Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Chemical burns must be treated promptly by a physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes severe burns. May cause an allergic skin reaction.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, alcohol-resistant foam or water spray (fog).

Unsuitable extinguishing media : Do not use water jet.

Section 5. Firefighting measures

Specific hazards arising from the chemical : Combustible liquid. Runoff to sewer may create fire or explosion hazard. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : 2X

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Do not breathe vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Section 7. Handling and storage

Protective measures : Put on appropriate personal protective equipment (see Section 8). Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not breathe vapour or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Keep away from acids. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Eliminate all ignition sources. Separate from acids. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
3,6-diazaoctanethylenediamin	**DFG MAC-values list (Germany, 7/2023). Skin sensitiser.**

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Section 8. Exposure controls and personal protection

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid.

Colour : Brown.

Odour : Not available.

Odour threshold : Not available.

pH : 11.3 to 13.3 [Conc. (% w/w): 100%]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : >250°C (>482°F)

Flash point : Closed cup: >70°C (>158°F)

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Vapour pressure : Not available.

Relative vapour density : Not available.

Relative density : 0.95 to 1.05

Solubility(ies) :

Section 9. Physical and chemical properties and safety characteristics

Media	Result
cold water	Very slightly soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : 280°C (536°F)

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

Incompatible materials : Reactive or incompatible with the following materials: oxidising materials and acids.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
3,6-diazaoctanethylenediamin	LD50 Dermal LD50 Oral	Rabbit Rat	805 mg/kg 2500 mg/kg	- -

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : Risk of serious damage to eyes. May cause eye burns and permanent eye injury.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : May cause sensitisation by skin contact. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Section 11. Toxicological information

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes severe burns. May cause an allergic skin reaction.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Product/ingredient name	Result	Species	Exposure
3,6-diazaoctanethylenediamin	Acute EC50 3700 µg/l Fresh water	Algae - *Pseudokirchneriella subcapitata*	96 hours
	Acute LC50 33900 µg/l Fresh water	Daphnia - *Daphnia magna*	48 hours

Persistence and degradability

Not available.

Product/ingredient name	$LogP_{ow}$	BCF	Potential
3,6-diazaoctanethylenediamin	-1.66 to -1.4	-	Low

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Vapour from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	UN2735	AMINES, LIQUID, CORROSIVE, N.O.S. (contains alkylamine)	8	III	
ADG	UN2735	AMINES, LIQUID, CORROSIVE, N.O.S. (contains alkylamine)	8	III	
IMDG	UN2735	AMINES, LIQUID, CORROSIVE, N.O.S. (contains alkylamine)	8	III	
IATA	UN2735	AMINES, LIQUID, CORROSIVE, N.O.S. (contains alkylamine)	8	III	

PG* : Packing group

Section 14. Transport information

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code 2X
ADG Class	No.	Hazchem code 2X
IMDG Class	No.	Emergency schedules F-A S-B
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 10 September 2024.

Date of issue/Date of revision : 10 September 2024

Date of previous issue : No previous validation

Version : 1

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
FLAMMABLE LIQUIDS - Category 4	On basis of test data
SKIN CORROSION/IRRITATION - Category 1	On basis of test data
SKIN SENSITISATION - Category 1	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : Calcium Chloride

Product code : 5008DF

ADG : -

Product type : Powder.

Identified uses : Weighting Agent / Salt.

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A

GHS label elements

Hazard pictograms :



GHS07

Signal word : WARNING

Hazard statements : H319 - Causes serious eye irritation.

Precautionary statements

Section 2. Hazard(s) identification

Prevention : Wear eye or face protection.

Response : IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice or attention.

Storage : Not applicable.

Disposal : Not applicable.

Precautionary statements (Code) : -, P280, P305 + P351 + P338, P337 + P313, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
calcium chloride	60 - 100	10043-52-4

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Section 4. First aid measures

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain or irritation,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : halogenated compounds,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Section 6. Accidental release measures

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Avoid dust generation. Using a vacuum with HEPA filter will reduce dust dispersal. Place spilled material in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing dust. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Section 8. Exposure controls and personal protection

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): neoprene or nitrile Gloves

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder or flakes.]

Colour : White.

Odour : Odourless.

Odour threshold : Not available.

pH : 9 to 10.5 [Conc. (% w/w): 10% - (H2O)]

Melting point/freezing point : 772°C

Boiling point, initial boiling point, and boiling range : 1600°C (2912°F)

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Section 9. Physical and chemical properties and safety characteristics

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 2.1 to 2.2

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Additional information : Water-reactive

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Hazardous reactions or instability may occur under certain conditions of storage or use.

Conditions to avoid : No specific data.

Incompatible materials : Reactive or incompatible with the following materials: moisture.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : May cause eye irritation.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Section 11. Toxicological information

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain or irritation,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
calcium chloride	Acute EC50 3130000 µg/l Fresh water	Algae - *Navicula seminulum*	96 hours
	Acute EC50 464000 µg/l Fresh water	Daphnia - *Daphnia magna*	48 hours
	Acute LC50 270 mg/l Marine water	Crustaceans - *Americamysis bahia*	48 hours
	Acute LC50 2110 mg/l Fresh water	Fish - *Pimephales promelas*	96 hours

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Section 14. Transport information

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 20 February 2024

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Version : 4

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships,

Section 16. Any other relevant information

1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : Caustic Soda

Product code : 6062DF

ADG : SODIUM HYDROXIDE, SOLID

Product type : Solid.

Identified uses : pH control.

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : CORROSIVE TO METALS - Category 1
SKIN CORROSION/IRRITATION - Category 1A
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1

GHS label elements

Hazard pictograms :



GHS05

Signal word : DANGER

Section 2. Hazard(s) identification

Hazard statements : H290 - May be corrosive to metals.
H314 - Causes severe skin burns and eye damage.

Precautionary statements

Prevention : Wear protective gloves: > 8 hours (breakthrough time): Neoprene gloves.. Wear protective clothing. Wear eye or face protection: Recommended: Chemical splash goggles. and face shield. Keep only in original packaging.

Response : Absorb spillage to prevent material damage. IF INHALED: Immediately call a POISON CENTER or doctor. IF SWALLOWED: Immediately call a POISON CENTER or doctor. Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. Immediately call a POISON CENTER or doctor. Wash contaminated clothing before reuse. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P280, P234, P390, P304 + P310, P301 + P310, P330, P331, P303 + P361 + P353, P310, P363, P305 + P351 + P338, P310, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : Causes digestive tract burns.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
sodium hydroxide; caustic soda	60 - 100	.1310-73-2

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Chemical burns must be treated promptly by a physician.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Section 4. First aid measures

Skin contact : Get medical attention immediately. Call a poison center or physician. Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Call a poison center or physician. Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Chemical burns must be treated promptly by a physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes severe burns.

Ingestion : Corrosive to the digestive tract. Causes burns.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Section 5. Firefighting measures

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : 2W

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Absorb spillage to prevent material damage. Avoid dust generation. Using a vacuum with HEPA filter will reduce dust dispersal. Place spilled material in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Absorb spillage to prevent material damage. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not get in eyes or on skin or clothing. Do not ingest. If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container. Absorb spillage to prevent material damage.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store in corrosive resistant container with a resistant inner liner. Store locked up. Keep away from metals. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
sodium hydroxide; caustic soda	**Safe Work Australia (Australia, 1/2014).** TWA: 2 mg/m³ 8 hours.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): Neoprene gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: If necessary half-face mask and particulate filter

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid.

Colour : White.

Odour : Odourless.

Odour threshold : Not available.

pH : 14 [Conc. (% w/w): 10% - (H2O)]

Melting point/freezing point : 323°C

Boiling point, initial boiling point, and boiling range : 1388°C (2530.4°F)

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 2.13 (20°C)

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Extremely reactive or incompatible with the following materials: acids.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : Causes pain and burns in contact with skin. May cause permanent skin damage.

Eyes : Risk of serious damage to eyes. May cause eye burns and permanent eye injury.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes severe burns.

Ingestion : Corrosive to the digestive tract. Causes burns.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Section 11. Toxicological information

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
sodium hydroxide; caustic soda	Acute EC50 40.38 mg/l Fresh water	Crustaceans - *Ceriodaphnia dubia* - Neonate	48 hours
	Acute LC50 80.59 ppm Marine water	Crustaceans - *Mysidopsis juniae*	96 hours
	Acute LC50 125 ppm Fresh water	Fish - *Gambusia affinis* - Adult	96 hours
	Chronic LOEL 125 ppm Marine water	Echinodermata - *Lytechinus variegatus*	-
	Chronic NOEC 62.5 ppm Marine water	Echinodermata - *Lytechinus variegatus*	-

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	UN1823	SODIUM HYDROXIDE, SOLID	8	II	
ADG	UN1823	SODIUM HYDROXIDE, SOLID	8	II	
IMDG	UN1823	SODIUM HYDROXIDE, SOLID	8	II	
IATA	UN1823	SODIUM HYDROXIDE, SOLID	8	II	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** 2W
ADG Class	No.	**Hazchem code** 2W
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

6

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

Section 15. Regulatory information

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 20 February 2024

Date of previous issue : 10 March 2023

Version : 5

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
CORROSIVE TO METALS - Category 1	Expert judgment
SKIN CORROSION/IRRITATION - Category 1A	Expert judgment
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1	Expert judgment

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

Section 16. Any other relevant information

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

CHEK-LOSS™

Version 5

Section 1. Identification

Product identifier : CHEK-LOSS™

Product code : 1094DF

ADG : -

Product type : Powder.

Identified uses : Lost Circulation Material

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
Cellulose	60 - 100	9004-34-6

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Section 4. First aid measures

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid breathing dust. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Cellulose	**Safe Work Australia (Australia, 10/2022).** TWA: 10 mg/m³ 8 hours. Form: fibres

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Section 8. Exposure controls and personal protection

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): Nitrile gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Light brown.

Odour : Odourless.

Odour threshold : Not available.

pH : Not available.

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 0.8 to 1

Solubility(ies) :

Media	Result
cold water	Not soluble

Section 9. Physical and chemical properties and safety characteristics

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Cellulose	LD50 Oral	Rat	>5 g/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Section 11. Toxicological information

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 20 February 2024

Date of previous issue : 10 March 2023

Version : 5

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

Section 16. Any other relevant information

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : CITRIC ACID

Product code : 5011DF

ADG : -

Product type : Solid.

Identified uses : Alkalinity Control

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A
SPECIFIC TARGET ORGAN TOXICITY - SINGLE EXPOSURE (Respiratory tract irritation) - Category 3

GHS label elements

Hazard pictograms :



GHS07

Signal word : WARNING

Section 2. Hazard(s) identification

Hazard statements : H315 - Causes skin irritation.
H319 - Causes serious eye irritation.
H335 - May cause respiratory irritation.

Precautionary statements

Prevention : Wear protective gloves: > 8 hours (breakthrough time): Neoprene gloves.. Wear eye or face protection. Avoid breathing dust. Wash thoroughly after handling.

Response : IF INHALED: Call a POISON CENTER or doctor if you feel unwell. Take off contaminated clothing and wash it before reuse. IF ON SKIN: Wash with plenty of water. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice or attention.

Storage : Store in a well-ventilated place. Keep container tightly closed.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P280, P261, P264, P304 + P312, P362 + P364, P302 + P352, P305 + P351 + P338, P337 + P313, P403 + P233, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : Causes digestive tract burns.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
Citric acid	60 - 100	77-92-9

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : May cause respiratory irritation.

Skin contact : Causes skin irritation.

Ingestion : Corrosive to the digestive tract. Causes burns.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain or irritation,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : irritation,redness

Ingestion : Adverse symptoms may include the following:,stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Avoid dust generation. Using a vacuum with HEPA filter will reduce dust dispersal. Place spilled material in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Section 8. Exposure controls and personal protection

Ingredient name	Exposure limits
Citric acid	**DFG MAC-values list (Germany, 7/2023).** PEAK: 4 mg/m³, 4 times per shift, 15 minutes. Form: inhalable fraction TWA: 2 mg/m³ 8 hours. Form: inhalable fraction

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): Neoprene gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: If necessary half-face mask and particulate filter

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid.

Colour : White.

Section 9. Physical and chemical properties and safety characteristics

Odour : Odourless.

Odour threshold : Not available.

pH : 2.1 [Conc. (% w/w): 0.1%]

Melting point/freezing point : 153°C

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: 100°C (212°F)

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 1.54

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Citric acid	LD50 Oral	Rat	3 g/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : May cause skin irritation.

Eyes : May cause eye irritation.

Respiratory : May cause respiratory irritation. Inhalation of the spray or mist may produce severe irritation of respiratory tract, characterised by coughing, choking or shortness of breath.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Product/ingredient name	Category	Route of exposure	Target organs
Citric acid	Category 3	-	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : May cause respiratory irritation.

Skin contact : Causes skin irritation.

Ingestion : Corrosive to the digestive tract. Causes burns.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain or irritation,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : irritation,redness

Ingestion : Adverse symptoms may include the following:,stomach pains

Section 11. Toxicological information

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
Citric acid	Acute LC50 160000 µg/l Marine water	Crustaceans - *Carcinus maenas* - Adult	48 hours
	Acute LC50 71 ppm Marine water	Crustaceans - *Mysidopsis juniae*	96 hours
	Chronic NOEC 7.81 ppm Marine water	Echinodermata - *Lytechinus variegatus*	-
	Chronic NOEL 15.62 ppm Marine water	Echinodermata - *Lytechinus variegatus*	-

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Citric acid	-1.8	-	Low

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Section 15. Regulatory information

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 20 February 2024

Date of previous issue : 10 March 2023

Version : 4

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
SKIN CORROSION/IRRITATION - Category 2	Calculation method
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A	Calculation method
SPECIFIC TARGET ORGAN TOXICITY - SINGLE EXPOSURE (Respiratory tract irritation) - Category 3	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : DESCO CF

Product code : 6279DF

ADG : -

Product type : Powder.

Identified uses : Not available

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : CARCINOGENICITY - Category 1
LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 3

GHS label elements

Hazard pictograms :



GHS08

Signal word : DANGER

Hazard statements : H350 - May cause cancer.
H412 - Harmful to aquatic life with long lasting effects.

Section 2. Hazard(s) identification

Precautionary statements

Prevention : Obtain special instructions before use. Wear protective gloves: > 8 hours (breakthrough time): nitrile Gloves. Wear protective clothing. Wear eye or face protection. Wear hearing protection. Avoid release to the environment.

Response : IF exposed or concerned: Get medical advice or attention.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P201, P280, P273, P308 + P313, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
Tannins, sulfomethylated	≥75 - ≤90	68201-64-9
crystalline silica, respirable powder	<1	14808-60-7

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Section 4. First aid measures

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed. This material is harmful to aquatic life with long lasting effects. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products : sulfur oxides,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities.

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing dust. Avoid release to the environment. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
crystalline silica, respirable powder	**Safe Work Australia (Australia, 4/2018).** TWA: 0.1 mg/m³ 8 hours. Form: Respirable dust

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): nitrile Gloves

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: If necessary half-face mask and particulate filter

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Red. / Brown.

Odour : Odourless.

Odour threshold : Not available.

pH : Not available.

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : Not available.

Solubility(ies) :

Media	Result
cold water	Very slightly soluble
hot water	Very slightly soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Section 9. Physical and chemical properties and safety characteristics

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Product/ingredient name	Category	Route of exposure	Target organs
crystalline silica, respirable powder	Category 1	inhalation	lungs

Aspiration hazard

Not available.

Section 11. Toxicological information

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Ingredient name	Schedule
crystalline silica, respirable powder	Restricted hazardous chemical [For abrasive blasting at a concentration of greater than 1%]

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

Section 15. Regulatory information

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 2

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
CARCINOGENICITY - Category 1 LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 3	Calculation method Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : DFE-281

Product code : DFE281

ADG : -

Product type : Liquid.

Identified uses : Wellbore sealant

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1
SKIN SENSITISATION - Category 1

GHS label elements

Hazard pictograms :



GHS05 GHS07

Signal word : DANGER

Section 2. Hazard(s) identification

Hazard statements : H315 - Causes skin irritation.
H317 - May cause an allergic skin reaction.
H318 - Causes serious eye damage.

Precautionary statements

Prevention : Wear protective gloves. Wear eye or face protection. Avoid breathing vapour. Wash thoroughly after handling.

Response : Take off contaminated clothing and wash it before reuse. IF ON SKIN: Wash with plenty of water. If skin irritation or rash occurs: Get medical advice or attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P280, P261, P264, P362 + P364, P302 + P352, P333 + P313, P305 + P351 + P338, P310, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
Cocamidopropyl betaine	≤10	61789-40-0

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Chemical burns must be treated promptly by a physician.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Section 4. First aid measures

Skin contact : Get medical attention immediately. Call a poison center or physician. Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes skin irritation. May cause an allergic skin reaction.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Section 5. Firefighting measures

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Do not breathe vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not breathe vapour or mist. Do not ingest. If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid.

Colour : White.

Odour : Rubber

Odour threshold : Not available.

pH : 7.5 to 10 [Conc. (% w/w): 100%]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not available.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Vapour pressure : Not available.

Relative vapour density : Not available.

Relative density : 1.015 to 1.05

Not Available.

Miscible with water : Yes.

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Reactive or incompatible with the following materials: oxidising materials.

Section 10. Stability and reactivity

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : May cause skin irritation.

Eyes : Risk of serious damage to eyes. May cause eye burns and permanent eye injury.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : May cause sensitisation by skin contact. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes skin irritation. May cause an allergic skin reaction.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Section 11. Toxicological information

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Section 14. Transport information

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code -
ADG Class	No.	Hazchem code -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 28 January 2025.

Date of issue/Date of revision : 28 January 2025

Date of previous issue : No previous validation

Version : 1

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
SKIN CORROSION/IRRITATION - Category 2	Expert judgment
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1	Expert judgment
SKIN SENSITISATION - Category 1	Expert judgment

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

DFE-659

Version 1

Section 1. Identification

Product identifier : DFE-659

Product code : DFE659

ADG : -

Product type : Liquid.

Identified uses : Lubricant.

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 4

GHS label elements

Signal word : No signal word.

Hazard statements : H413 - May cause long lasting harmful effects to aquatic life.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Prevention : Avoid release to the environment.

Response : Not applicable.

Section 2. Hazard(s) identification

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : P103, P102, P101, P273, -, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
Fatty acids, C8-16, 2-ethylhexyl esters	≥30 - ≤60	135800-37-2
Natural graphite	≤10	7782-42-5

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Section 4. First aid measures

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst. This material may cause long lasting harmful effects to aquatic life. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Avoid breathing vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities.

Methods and material for containment and cleaning up

Section 6. Accidental release measures

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapour or mist. Avoid release to the environment. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Natural graphite	**Safe Work Australia (Australia, 1/2014).** TWA: 3 mg/m³ 8 hours. Form: Respirable dust

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Section 8. Exposure controls and personal protection

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid.

Colour : Yellow to amber.

Odour : Odourless.

Odour threshold : Not available.

pH : Not available.

Melting point/freezing point : <-10°C

Boiling point, initial boiling point, and boiling range : >250°C (>482°F)

Flash point : Open cup: >200°C (>392°F) [ASTM D92]

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Vapour pressure : Not available.

Relative vapour density : Not available.

Section 9. Physical and chemical properties and safety characteristics

Relative density : Not available.

Solubility(ies) :

Media	Result
cold water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : >300°C (>572°F)

Decomposition temperature : Not available.

Viscosity : Kinematic (40°C): 110 cSt

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
DFE-659	LD50 Oral	Rat	5000 mg/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Section 11. Toxicological information

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Fatty acids, C8-16, 2-ethylhexyl esters	6.68 to 8.65	-	High

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	-
ADG Class	No.	-
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 6 January 2025.

Date of issue/Date of revision : 6 January 2025

Date of previous issue : No previous validation

Version : 1

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 4	Calculation method

Section 16. Any other relevant information

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : DFE-950

Product code : DFE950

ADG : -

Product type : Powder.

Identified uses : Lost Circulation Material

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : CARCINOGENICITY - Category 1
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2

GHS label elements

Hazard pictograms :



GHS08

Signal word : DANGER

Section 2. Hazard(s) identification

Hazard statements : H350 - May cause cancer.
H373 - May cause damage to organs through prolonged or repeated exposure. (lungs)

Precautionary statements

Prevention : Obtain special instructions before use. Wear protective gloves, protective clothing and eye or face protection. Do not breathe dust or mist.

Response : IF exposed or concerned: Get medical advice or attention.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P201, P280, P260, P308 + P313, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
Cellulose	≥30 - ≤60	9004-34-6
Limestone	≥30 - ≤60	1317-65-3
crystalline silica, respirable powder	≤5	.14808-60-7

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 5. Firefighting measures

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe dust. Do not ingest. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
DFE-950	**EH40/2005 WELs (United Kingdom (UK)).** TWA: 0.1 mg/m³, (Respirable dust) STEL: 0.3 mg/m³, (Respirable dust)
Cellulose	**Safe Work Australia (Australia, 1/2024).** TWA: 10 mg/m³ 8 hours. Form: fibres
Limestone	**EH40/2005 WELs (United Kingdom (UK), 8/2018).** TWA: 10 mg/m³ 8 hours. Form: inhalable dust TWA: 4 mg/m³ 8 hours. Form: respirable dust
crystalline silica, respirable powder	**Safe Work Australia (Australia, 1/2014).** TWA: 0.1 mg/m³ 8 hours. Form: Respirable dust

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Section 8. Exposure controls and personal protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Off-white. - Brown.

Odour : Odourless.

Odour threshold : Not available.

pH : Not available.

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 2

Solubility(ies) :

Media	Result
cold water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Section 9. Physical and chemical properties and safety characteristics

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Reactive or incompatible with the following materials: acids.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Cellulose	LD50 Oral	Rat	>5 g/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Section 11. Toxicological information

Not available.

Specific target organ toxicity (repeated exposure)

Product/ingredient name	Category	Route of exposure	Target organs
crystalline silica, respirable powder	Category 1	inhalation	lungs

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : May cause damage to organs through prolonged or repeated exposure. Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
DFE-950	Acute EC50 440 mg/l	Algae - *Pseudokirchneriella subcapitata*	72 hours

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 24 April 2025.

Date of issue/Date of revision : 24 April 2025

Date of previous issue : No previous validation

Version : 1

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Section 16. Any other relevant information

Classification	Justification
CARCINOGENICITY - Category 1 SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2	Calculation method Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

DRILLING STARCH

Version 1

Section 1. Identification

Product identifier : DRILLING STARCH

Product code : 9111DF

ADG : -

Product type : Powder.

Identified uses : Drilling fluid additive. Fluid loss control

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
Modified starch	60 - 100	Various

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Section 4. First aid measures

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : No specific data.

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 6. Accidental release measures

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid breathing dust. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Section 8. Exposure controls and personal protection

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): Nitrile or Neoprene gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Off-white.

Odour : Odourless.

Odour threshold : Not available.

pH : Not available.

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 1.5 (20°C)

Solubility(ies) :

Media	Result
cold water hot water	Easily soluble Easily soluble

Section 9. Physical and chemical properties and safety characteristics

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Reactive or incompatible with the following materials: oxidising materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Section 11. Toxicological information

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

Section 15. Regulatory information

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 30 December 2024.

Date of issue/Date of revision : 30 December 2024

Date of previous issue : No previous validation

Version : 1

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

Section 16. Any other relevant information

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

DRISTEMP POLYMER

Section 1. Identification

Product identifier	:	Dristemp Polymer
Product code	:	Dristemp Polymer
ADG	:	-
Product type	:	Powder
Identified uses	:	Drilling Fluid Additive
Importer's details	:	Baker Hughes, Australia 631 Karel Avenue, Jandakot, Western Australia 6164, Australia Tel: 08 6595 7100
Manufacturer's details	:	CHEVRON PHILLIPS CHEMICAL COMPANY LP DRILLING SPECIALTIES COMPANY LLC 10001 Six Pines Drive The Woodlands TX 77380 USA
Emergency telephone number	:	CHEMTREC Emergency Telephone Numbers (Asia Pacific Region): - Australia: (02) 9037 2994 - Brunei: +(65)-31581349 (Mandarin/English) - China: 4001-204937 (Mandarin) * - Hong Kong: 800-968-793 (Cantonese) * - Indonesia: 001-803-017-9114 (Bahasa Indonesian) * - Japan: +(81)-345209637 (Japanese) - Malaysia: 1-800-815-308 (Bahasa Malay) * - New Zealand: 09 801 0034 - Philippines: 1-800-1-116-1020 (Tagalog) * - PNG: +(61) 2 9037 2994 - Singapore: 800-101-2201 (Mandarin) * - South Korea: 00-308-13-2549 (Korean) * - Taiwan: 00801-14-8954 (Mandarin) * - Thailand: 001-800-13-203-9987 (Thai) * - Vietnam: +(84)-838012436 (Vietnamese) - UK: +(44) 870-820-0418 - USA: +(1) 703-527-3887 (CHEMTREC International 24 hour) * Number can only be dialled in-country
Date	:	20 May 2024

This is a Baker Hughes cover page for our Supplier's SDS. A copy of this SDS has been provided to CHEMTREC
Baker Hughes Confidential

SAFETY DATA SHEET

Dristemp® Polymer

Version 1.6 Revision Date 2021-06-21

according to GB/T 16483 and GB/T 17519

SECTION 1: Identification of the substance/mixture and of the company/undertaking

Product information

Product Name : Dristemp® Polymer
Material : 1097220

Use : Drilling Fluid Additive

Company : Chevron Phillips Chemical Company LP
Drilling Specialties Company LLC
10001 Six Pines Drive
The Woodlands, TX 77380

Local : See Company Address

Emergency telephone:

Health:
866.442.9628 (North America)
1.832.813.4984 (International)
Transport:
CHEMTREC 800.424.9300 or 703.527.3887(int'l)
Asia: CHEMWATCH (+612 9186 1132) China: 0532 8388 9090
EUROPE: BIG +32.14.584545 (phone) or +32.14583516 (telefax)
Mexico CHEMTREC 01-800-681-9531 (24 hours)
South America SOS-Cotec Inside Brazil: 0800.111.767 Outside Brazil: +55.19.3467.1600
Argentina: +(54)-1159839431

Responsible Department : Product Safety and Toxicology Group
E-mail address : SDS@CPChem.com
Website : www.CPChem.com

SECTION 2: Hazards identification

Classification of the substance or mixture
GHS Classification and Labeling: Follow GB 13690, GB 15258 and GB 30000.2 to GB 30000.29 (GHS 2011)

Emergency Overview

Form: Powder **Physical state**: solid **Color**: White **Odor**: no odor

Classification

Not a hazardous substance or mixture.

Labeling

Not a hazardous substance or mixture.

SECTION 3: Composition/information on ingredients

Synonyms	:	None established
Molecular formula	:	Proprietary

Contains no hazardous ingredients according to GHS.

SECTION 4: First aid measures

General advice	:	No hazards which require special first aid measures.
If inhaled	:	If unconscious, place in recovery position and seek medical advice. If symptoms persist, call a physician.
In case of eye contact	:	Remove contact lenses. Protect unharmed eye. If eye irritation persists, consult a specialist.
If swallowed	:	Keep respiratory tract clear. Do not give milk or alcoholic beverages. Never give anything by mouth to an unconscious person. If symptoms persist, call a physician.

SECTION 5: Firefighting measures

Flash point	:	Not applicable
Autoignition temperature	:	No data available
Suitable extinguishing media	:	Avoid the use of straight streams that may create a dust cloud and the risk of a dust explosion.
Specific hazards during fire fighting	:	Risks of ignition followed by flame propagation or secondary explosions can be caused by the accumulation of dust, e.g. on floors and ledges.
Special protective equipment for fire-fighters	:	Wear self-contained breathing apparatus for firefighting if necessary.
Further information	:	Standard procedure for chemical fires. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Fire and explosion protection	:	Avoid generating dust; fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard. Provide appropriate exhaust ventilation at places where dust is formed.

Hazardous decomposition products	:	Carbon oxides. Sulfur oxides.

SECTION 6: Accidental release measures

Personal precautions	:	Avoid dust formation.
Environmental precautions	:	No special environmental precautions required.
Methods for cleaning up	:	Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.
Additional advice	:	Contaminated surfaces will be extremely slippery. Avoid spillage on floor as the product can become very slippery when wet. Sweep up to prevent slipping hazard. Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are released into the atmosphere in sufficient concentration. Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air).

SECTION 7: Handling and storage

Handling

Advice on safe handling	:	For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area.
Advice on protection against fire and explosion	:	Avoid generating dust; fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard. Provide appropriate exhaust ventilation at places where dust is formed.

Storage

Requirements for storage areas and containers	:	Electrical installations / working materials must comply with the technological safety standards.
Advice on common storage	:	No materials to be especially mentioned.
Use	:	Drilling Fluid Additive

SECTION 8: Exposure controls/personal protection

Ingredients with workplace control parameters

CN

Components	Basis	Value	Control parameters	Note
Urea	CN OEL	PC-TWA	5 mg/m3	
	CN OEL	PC-STEL	10 mg/m3	

Not applicable

Engineering measures

Adequate ventilation to control airborned concentrations below the exposure guidelines/limits.

Consider the potential hazards of this material (see Section 2), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

Personal protective equipment

Respiratory protection	:	Wear a supplied-air NIOSH approved respirator unless ventilation or other engineering controls are adequate to maintain minimal oxygen content of 19.5% by volume under normal atmospheric pressure. Wear a NIOSH approved respirator that provides protection when working with this material if exposure to harmful levels of airborne material may occur, such as:. Air-Purifying Respirator for Organic Vapors, Dusts and Mists. Use a positive pressure, air-supplying respirator if there is potential for uncontrolled release, aerosolization, exposure levels are not known, or other circumstances where air-purifying respirators may not provide adequate protection.
Hand protection	:	The suitability for a specific workplace should be discussed with the producers of the protective gloves. Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. Also take into consideration the specific local conditions under which the product is used, such as the danger of cuts, abrasion, and the contact time. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough.
Eye protection	:	Eye wash bottle with pure water. Safety glasses.
Skin and body protection	:	Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place. Wear as appropriate:. Protective suit. Safety shoes.
Hygiene measures	:	General industrial hygiene practice.

SECTION 9: Physical and chemical properties

Information on basic physical and chemical properties

Appearance

Form	:	Powder
Physical state	:	solid
Color	:	White
Odor	:	no odor
Odor Threshold	:	No data available

Safety data

Flash point	:	Not applicable
Lower explosion limit	:	No data available

Upper explosion limit	:	No data available
Oxidizing properties	:	No
Autoignition temperature	:	No data available
Molecular formula	:	Proprietary
Molecular weight	:	No data available
pH	:	No data available
Freezing point	:	Not applicable
Pour point		Not applicable
Boiling point/boiling range	:	Not applicable
Vapor pressure	:	Not applicable
Relative density	:	1.44
Water solubility	:	Completely Soluble
Partition coefficient: n-octanol/water	:	No data available
Viscosity, dynamic	:	Not applicable
Viscosity, kinematic	:	Not applicable
Relative vapor density	:	Not applicable
Evaporation rate	:	No data available

SECTION 10: Stability and reactivity

Reactivity : Stable at normal ambient temperature and pressure.

Chemical stability : This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

Possibility of hazardous reactions

Hazardous reactions : Further information: Stable under recommended storage conditions., No hazards to be specially mentioned.

Conditions to avoid : Generation of Dusts.

Materials to avoid : May react with oxygen and strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.

Hazardous decomposition products : Carbon oxides
Sulfur oxides

Other data : No decomposition if stored and applied as directed.

SECTION 11: Toxicological information

Dristemp® Polymer
Further information : Product dust may be irritating to eyes, skin and respiratory system.

SECTION 12: Ecological information

Ecotoxicity effects

Biodegradability : This material is not expected to be readily biodegradable.

Elimination information (persistence and degradability)

Bioaccumulation : This material is not expected to bioaccumulate.

Mobility : No data available

Additional ecological information : This material is not expected to be harmful to aquatic organisms.

Ecotoxicology Assessment

Short-term (acute) aquatic hazard : This product has no known ecotoxicological effects.

Long-term (chronic) aquatic hazard : This product has no known ecotoxicological effects.

SECTION 13: Disposal considerations

The information in this SDS pertains only to the product as shipped.

Use material for its intended purpose or recycle if possible. This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA under RCRA (40 CFR 261) or other State and local regulations. Measurement of certain physical properties and analysis for regulated components may be necessary to make a correct determination. If this material is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.

Contaminated packaging : Empty containers should be taken to an approved waste handling site for recycling or disposal.

SECTION 14: Transport information

The shipping descriptions shown here are for bulk shipments only, and may not apply to

shipments in non-bulk packages (see regulatory definition).

Consult the appropriate domestic or international mode-specific and quantity-specific Dangerous Goods Regulations for additional shipping description requirements (e.g., technical name or names, etc.) Therefore, the information shown here, may not always agree with the bill of lading shipping description for the material. Flashpoints for the material may vary slightly between the SDS and the bill of lading.

US DOT (UNITED STATES DEPARTMENT OF TRANSPORTATION)
NOT REGULATED AS A HAZARDOUS MATERIAL OR DANGEROUS GOODS FOR TRANSPORTATION BY THIS AGENCY.

IMO / IMDG (INTERNATIONAL MARITIME DANGEROUS GOODS)
NOT REGULATED AS A HAZARDOUS MATERIAL OR DANGEROUS GOODS FOR TRANSPORTATION BY THIS AGENCY.

IATA (INTERNATIONAL AIR TRANSPORT ASSOCIATION)
NOT REGULATED AS A HAZARDOUS MATERIAL OR DANGEROUS GOODS FOR TRANSPORTATION BY THIS AGENCY.

ADR (AGREEMENT ON DANGEROUS GOODS BY ROAD (EUROPE))
NOT REGULATED AS A HAZARDOUS MATERIAL OR DANGEROUS GOODS FOR TRANSPORTATION BY THIS AGENCY.

RID (REGULATIONS CONCERNING THE INTERNATIONAL TRANSPORT OF DANGEROUS GOODS (EUROPE))
NOT REGULATED AS A HAZARDOUS MATERIAL OR DANGEROUS GOODS FOR TRANSPORTATION BY THIS AGENCY.

ADN (EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY INLAND WATERWAYS)
NOT REGULATED AS A HAZARDOUS MATERIAL OR DANGEROUS GOODS FOR TRANSPORTATION BY THIS AGENCY.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

SECTION 15: Regulatory information

Notification status

Europe REACH	:	This mixture contains only ingredients which have been registered according to Regulation (EU) No. 1907/2006 (REACH).
Switzerland CH INV	:	Not in compliance with the inventory
United States of America (USA) TSCA	:	On or in compliance with the active portion of the TSCA inventory
Canada DSL	:	All components of this product are on the Canadian

		DSL
Other AIIC	:	On the inventory, or in compliance with the inventory
New Zealand NZIoC	:	Not in compliance with the inventory
Japan ENCS	:	Not in compliance with the inventory
Philippines PICCS	:	On the inventory, or in compliance with the inventory
Taiwan TCSI	:	Not in compliance with the inventory
Korea KECI	:	A substance(s) in this product was not registered, notified to be registered, or exempted from registration by CPChem according to K-REACH regulations. Importation or manufacture of this product is still permitted provided the Korean Importer of Record has themselves notified the substance or the exported amount does not exceed the minimum threshold quantity of the non-registered substance(s).
China IECSC	:	On the inventory, or in compliance with the inventory
Other regulations	:	Law on the Prevention and Control of Occupational Diseases

SECTION 16: Other information

Further information

Legacy SDS Number : CPC00417

Significant changes since the last version are highlighted in the margin. This version replaces all previous versions.

The information in this SDS pertains only to the product as shipped.

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Key or legend to abbreviations and acronyms used in the safety data sheet			
ACGIH	American Conference of Government Industrial Hygienists	LD50	Lethal Dose 50%
AICS	Australia, Inventory of Chemical Substances	LOAEL	Lowest Observed Adverse Effect Level
DSL	Canada, Domestic Substances List	NFPA	National Fire Protection Agency
NDSL	Canada, Non-Domestic Substances List	NIOSH	National Institute for Occupational Safety & Health
CNS	Central Nervous System	NTP	National Toxicology Program
CAS	Chemical Abstract Service	NZIoC	New Zealand Inventory of Chemicals
EC50	Effective Concentration	NOAEL	No Observable Adverse Effect Level
EC50	Effective Concentration 50%	NOEC	No Observed Effect Concentration
EGEST	EOSCA Generic Exposure Scenario Tool	OSHA	Occupational Safety & Health Administration
EOSCA	European Oilfield Specialty Chemicals Association	PEL	Permissible Exposure Limit
EINECS	European Inventory of Existing Chemical Substances	PICCS	Philippines Inventory of Commercial Chemical Substances
MAK	Germany Maximum Concentration	PRNT	Presumed Not Toxic

	Values		
GHS	Globally Harmonized System	RCRA	Resource Conservation Recovery Act
>=	Greater Than or Equal To	STEL	Short-term Exposure Limit
IC50	Inhibition Concentration 50%	SARA	Superfund Amendments and Reauthorization Act.
IARC	International Agency for Research on Cancer	TLV	Threshold Limit Value
IECSC	Inventory of Existing Chemical Substances in China	TWA	Time Weighted Average
ENCS	Japan, Inventory of Existing and New Chemical Substances	TSCA	Toxic Substance Control Act
KECI	Korea, Existing Chemical Inventory	UVCB	Unknown or Variable Composition, Complex Reaction Products, and Biological Materials
<=	Less Than or Equal To	WHMIS	Workplace Hazardous Materials Information System
LC50	Lethal Concentration 50%		

Section 1. Identification

Product identifier : ECCO-TEMP™

Product code : 1146DF

ADG : -

Product type : Liquid.

Identified uses : Temperature Stabilizer

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A
SPECIFIC TARGET ORGAN TOXICITY - SINGLE EXPOSURE (Respiratory tract irritation) - Category 3

GHS label elements

Hazard pictograms :



GHS07

Signal word : WARNING

Section 2. Hazard(s) identification

Hazard statements : H315 - Causes skin irritation.
H319 - Causes serious eye irritation.
H335 - May cause respiratory irritation.

Precautionary statements

Prevention : Wear protective gloves: > 8 hours (breakthrough time): Butyl rubber gloves.. Wear eye or face protection. Avoid breathing vapour. Wash thoroughly after handling.

Response : IF INHALED: Call a POISON CENTER or doctor if you feel unwell. Take off contaminated clothing and wash it before reuse. IF ON SKIN: Wash with plenty of water. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice or attention.

Storage : Store in a well-ventilated place. Keep container tightly closed.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P280, P261, P264, P304 + P312, P362 + P364, P302 + P352, P305 + P351 + P338, P337 + P313, P403 + P233, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
Triethanolamine	≥60 - ≤75	102-71-6

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : May cause respiratory irritation.

Skin contact : Causes skin irritation.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain or irritation,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : irritation,redness

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Avoid breathing vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapour or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Triethanolamine	**Safe Work Australia (Australia, 10/2022). Skin sensitiser. Inhalation sensitiser.** TWA: 5 mg/m³ 8 hours.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): Butyl rubber gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: Not normally needed.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid. [Clear.]

Colour : Colourless.

Odour : Not available.

Odour threshold : Not available.

pH : 10 [Conc. (% w/w): 1% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : 335°C (635°F)

Flash point : Closed cup: 179°C (354.2°F) [Closed cup]

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Vapour pressure : Not available.

Relative vapour density : Not available.

Relative density : 1.05 to 1.15

Not Available.

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Triethanolamine	LD50 Oral	Rat	7.39 g/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : May cause skin irritation.

Eyes : May cause eye irritation.

Respiratory : May cause respiratory irritation. Inhalation of the spray or mist may produce severe irritation of respiratory tract, characterised by coughing, choking or shortness of breath.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Product/ingredient name	Category	Route of exposure	Target organs
Triethanolamine	Category 3	-	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : May cause respiratory irritation.

Skin contact : Causes skin irritation.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain or irritation,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : irritation,redness

Section 11. Toxicological information

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
Triethanolamine	Acute LC50 100000 µg/l Marine water	Crustaceans - *Crangon crangon* - Adult	48 hours
	Acute LC50 11800000 µg/l Fresh water	Fish - *Pimephales promelas*	96 hours
	Chronic NOEC 16000 µg/l Fresh water	Daphnia - *Daphnia magna*	21 days

Persistence and degradability

Not available.

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Triethanolamine	-1	<3.9	Low

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code -
ADG Class	No.	Hazchem code -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

List name	Ingredient name	Status
Schedule III	Triethanolamine	Listed

Montreal Protocol

Section 15. Regulatory information

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 1 August 2023

Version : 2

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
SKIN CORROSION/IRRITATION - Category 2	Calculation method
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A	Calculation method
SPECIFIC TARGET ORGAN TOXICITY - SINGLE EXPOSURE (Respiratory tract irritation) - Category 3	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : FLOW-CARB™ Series

Product code : 1758DF

ADG : -

Product type : Powder.

Identified uses : Bridging and Lost Circulation Material

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : CARCINOGENICITY - Category 1
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2

GHS label elements

Hazard pictograms :



GHS08

Signal word : DANGER

Section 2. Hazard(s) identification

Hazard statements : H350 - May cause cancer.
H373 - May cause damage to organs through prolonged or repeated exposure. (lungs)

Precautionary statements

Prevention : Obtain special instructions before use. Wear protective gloves: > 8 hours (breakthrough time): Rubber gloves.. Wear protective clothing. Wear eye or face protection. Wear hearing protection. Do not breathe dust or mist.

Response : IF exposed or concerned: Get medical advice or attention.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P201, P280, P260, P308 + P313, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
Limestone	60 - 100	1317-65-3
crystalline silica, respirable powder	1 - 5	14808-60-7

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 5. Firefighting measures

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe dust. Do not ingest. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Limestone	**EH40/2005 WELs (United Kingdom (UK), 8/2018).** TWA: 10 mg/m³ 8 hours. Form: inhalable dust TWA: 4 mg/m³ 8 hours. Form: respirable dust
crystalline silica, respirable powder	**Safe Work Australia (Australia, 4/2018).** TWA: 0.1 mg/m³ 8 hours. Form: Respirable dust

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): Rubber gloves.

Section 8. Exposure controls and personal protection

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: If necessary half-face mask and particulate filter

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : White.

Odour : Odourless.

Odour threshold : Not available.

pH : 8.6 to 9.5 [Conc. (% w/w): 10% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : Not available.

Solubility(ies) :

Media	Result
cold water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Section 9. Physical and chemical properties and safety characteristics

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Product/ingredient name	Category	Route of exposure	Target organs
crystalline silica, respirable powder	Category 1	inhalation	lungs

Aspiration hazard

Not available.

Section 11. Toxicological information

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : May cause damage to organs through prolonged or repeated exposure. Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Ingredient name	Schedule
crystalline silica, respirable powder	Restricted hazardous chemical [For abrasive blasting at a concentration of greater than 1%]

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

Section 15. Regulatory information

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 3

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
CARCINOGENICITY - Category 1	Calculation method
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : FP-16L
Product code : 222220
ADG : -
Product type : Liquid.

Identified uses : Anti-foamer

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : ASPIRATION HAZARD - Category 1

GHS label elements

Hazard pictograms :



GHS08

Signal word : DANGER

Hazard statements : H304 - May be fatal if swallowed and enters airways.
AUH066 - Repeated exposure may cause skin dryness or cracking

Section 2. Hazard(s) identification

Precautionary statements

Prevention : Not applicable.

Response : IF SWALLOWED: Immediately call a POISON CENTER or doctor. Do NOT induce vomiting.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, -, P301 + P310, P331, -, P501

Supplemental label elements : Repeated exposure may cause skin dryness or cracking.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
Hydrocarbons, C14-C17, n-alkanes, <2% aromatics	50 - 75	64771-72-8
Hydrocarbons, C10-C14, n-alkanes, isoalkanes, <2% aromatics	25 - 50	64771-72-8

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Additional information

This product is a mixture. Chemical family :

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Wash skin thoroughly with soap and water or use recognised skin cleanser. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Aspiration hazard if swallowed. Can enter lungs and cause damage. Do not induce vomiting. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Section 4. First aid measures

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : Defatting to the skin. May cause skin dryness and irritation.

Ingestion : May be fatal if swallowed and enters airways.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : irritation,dryness,cracking

Ingestion : Adverse symptoms may include the following:,nausea or vomiting

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : No specific data.

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Avoid breathing vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Section 6. Accidental release measures

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not swallow. Avoid contact with eyes, skin and clothing. Avoid breathing vapour or mist. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Section 8. Exposure controls and personal protection

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): polyvinyl chloride (PVC) , Nitrile. Neoprene gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: If necessary half-face mask and organic vapour (Type A) and particulate filter

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid.

Colour : White. [Light]

Odour : Hydrocarbon.

Odour threshold : Not available.

pH : Not available.

Melting point/freezing point : <-1°C

Boiling point, initial boiling point, and boiling range : 228 to 258°C (442.4 to 496.4°F)

Flash point : Closed cup: 97°C (206.6°F) [ASTM D93]

Evaporation rate : Not available.

Section 9. Physical and chemical properties and safety characteristics

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Vapour pressure : Not available.

Relative vapour density : Not available.

Relative density : 0.77 to 0.79

Solubility(ies) :

Media	Result
cold water hot water	Not soluble Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Reactive or incompatible with the following materials: oxidising materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Section 11. Toxicological information

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Product/ingredient name	Result
FP-16L	ASPIRATION HAZARD - Category 1
Hydrocarbons, C14-C17, n-alkanes, <2% aromatics	ASPIRATION HAZARD - Category 1
Hydrocarbons, C10-C14, n-alkanes, isoalkanes, <2% aromatics	ASPIRATION HAZARD - Category 1

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : Defatting to the skin. May cause skin dryness and irritation.

Ingestion : May be fatal if swallowed and enters airways.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : irritation,dryness,cracking

Ingestion : Adverse symptoms may include the following:,nausea or vomiting

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Prolonged or repeated contact can defat the skin and lead to irritation, cracking and/or dermatitis.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Section 11. Toxicological information

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

5

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 3 March 2024.

Date of issue/Date of revision : 3 March 2024

Date of previous issue : 26 February 2024

Version : 3

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
ASPIRATION HAZARD - Category 1	Expert judgment

Section 16. Any other relevant information

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

KEM-SEAL™ PLUS

Version 1

Section 1. Identification

Product identifier : KEM-SEAL™ PLUS

Product code : 9043DF

ADG : -

Product type : Solid.

Identified uses : High Temperature Filtration Control Agent

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
Copolymer, sodium salt, dimethylacrylamide, acrylamidomethyl propane sulfonic	60 - 100	Proprietary

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Section 4. First aid measures

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides,sulfur oxides,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Beads.]

Colour : White.

Odour : Odourless.

Odour threshold : Not available.

pH : 5 to 8 [Conc. (% w/w): 0.5% - (H2O)]

Melting point/freezing point : >150°C

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 0.6 to 0.9

Solubility(ies) :

Media	Result
cold water	Soluble
hot water	Soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Section 11. Toxicological information

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Section 14. Transport information

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	-
ADG Class	No.	-
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 17 November 2024.

Date of issue/Date of revision : 17 November 2024

Date of previous issue : No previous validation

Version : 1

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

KEM-SEAL™

Version 7

Section 1. Identification

Product identifier : KEM-SEAL™

Product code : 1134DF

ADG : -

Product type : Solid.

Identified uses : Filtration Control Agent

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

There are no ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Section 4. First aid measures

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides,sulfur oxides,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): Nitrile gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Granular solid.]

Colour : White. - Tan.

Odour : Odourless.

Odour threshold : Not available.

pH : Not available.

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 1.5 to 1.6

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Section 11. Toxicological information

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Section 14. Transport information

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code -
ADG Class	No.	Hazchem code -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 7

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

LC-LUBE™ (All Grades)

Version 4

Section 1. Identification

Product identifier : LC-LUBE™ (All Grades)

Product code : 1144DF

ADG : -

Product type : Powder.

Identified uses : Solid lubricant. / Lost Circulation Material

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
Natural graphite	60 - 100	7782-42-5

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Section 4. First aid measures

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Avoid breathing dust. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid breathing dust.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Natural graphite	**Safe Work Australia (Australia, 1/2014).** TWA: 3 mg/m³ 8 hours. Form: Respirable dust

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): nitrile Gloves

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: If necessary half-face mask and particulate filter

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Grey. to Black. [Dark]

Odour : Odourless.

Odour threshold : Not available.

pH : 6.5 to 10.5 [Conc. (% w/w): 10% - (H2O)]

Melting point/freezing point : >2000°C

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : 0.18 kPa (1.33 mm Hg)

Relative vapour density : Not applicable.

Relative density : 2.25

Solubility(ies) :

Media	Result
cold water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : >250°C

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Section 9. Physical and chemical properties and safety characteristics

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Section 11. Toxicological information

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code -
ADG Class	No.	Hazchem code -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Section 15. Regulatory information

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 4

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

LC-LUBE™ Fine

Version 3

Section 1. Identification

Product identifier : LC-LUBE™ Fine

Product code : 5188DF

ADG : -

Product type : Powder.

Identified uses : Solid lubricant. / Lost Circulation Material

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
Natural graphite	60 - 100	7782-42-5

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Section 4. First aid measures

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Avoid breathing dust. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid breathing dust.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Natural graphite	**Safe Work Australia (Australia, 1/2014).** TWA: 3 mg/m³ 8 hours. Form: Respirable dust

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Grey. to Black. [Dark]

Odour : Odourless.

Odour threshold : Not available.

pH : 6.5 to 10.5 [Conc. (% w/w): 10% - (H2O)]

Melting point/freezing point : >2000°C

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : 0.18 kPa (1.33 mm Hg)

Relative vapour density : Not applicable.

Relative density : 2.25

Solubility(ies) :

Media	Result
cold water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : >250°C

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Section 9. Physical and chemical properties and safety characteristics

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Section 11. Toxicological information

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Section 15. Regulatory information

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 3

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

Magnesium Oxide

Version 3

Section 1. Identification

Product identifier : Magnesium Oxide

Product code : 1080DF

ADG : -

Product type : Solid.

Identified uses : pH control.

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
magnesium oxide	60 - 100	1309-48-4

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Section 4. First aid measures

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
magnesium oxide	**Safe Work Australia (Australia, 10/2022).** TWA: 10 mg/m³ 8 hours. Form: Fume

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): Nitrile gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Crystalline solid.]

Colour : White.

Odour : Odourless.

Odour threshold : Not available.

pH : 10 [Conc. (% w/w): 10% - (H2O)]

Melting point/freezing point : 2852°C

Boiling point, initial boiling point, and boiling range : 3600°C (6512°F)

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 3.58 (20°C)

Solubility(ies) :

Media	Result
cold water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Section 11. Toxicological information

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
magnesium oxide	Acute LC50 180.91 ppm Marine water	Crustaceans - *Mysidopsis juniae*	96 hours
	Chronic LOEL 250 ppm Marine water	Echinodermata - *Lytechinus variegatus*	-
	Chronic NOEC 125 ppm Marine water	Echinodermata - *Lytechinus variegatus*	-

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code -
ADG Class	No.	Hazchem code -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Section 15. Regulatory information

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 3

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

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SAFETY DATA SHEET

MAX-GUARD™ PLUS

Version 2

Section 1. Identification

Product identifier : MAX-GUARD™ PLUS

Product code : 6247DF

ADG : -

Product type : Liquid.

Identified uses : Shale Control Additive

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : ACUTE TOXICITY (oral) - Category 4
ACUTE TOXICITY (dermal) - Category 4
SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1
SKIN SENSITISATION - Category 1
SPECIFIC TARGET ORGAN TOXICITY - SINGLE EXPOSURE (Respiratory tract irritation) - Category 3
LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 3

GHS label elements

Section 2. Hazard(s) identification

Hazard pictograms :



GHS05 GHS07

Signal word : DANGER

Hazard statements : H302 + H312 - Harmful if swallowed or in contact with skin.
H315 - Causes skin irritation.
H317 - May cause an allergic skin reaction.
H318 - Causes serious eye damage.
H335 - May cause respiratory irritation.
H412 - Harmful to aquatic life with long lasting effects.

Precautionary statements

Prevention : Wear protective gloves: > 8 hours (breakthrough time): neoprene or PVC or Nitrile gloves.. Wear protective clothing. Wear eye or face protection: Recommended: Chemical splash goggles.. Avoid release to the environment. Avoid breathing vapour. Do not eat, drink or smoke when using this product. Wash thoroughly after handling.

Response : IF INHALED: Call a POISON CENTER or doctor if you feel unwell. Take off contaminated clothing and wash it before reuse. IF ON SKIN: Call a POISON CENTER or doctor if you feel unwell. Wash with plenty of water. If skin irritation or rash occurs: Get medical advice or attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor.

Storage : Store in a well-ventilated place. Keep container tightly closed.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : P280, P273, P261, P270, P264, P304 + P312, P362 + P364, P302 + P312, P352, P333 + P313, P305 + P351 + P338, P310, P403 + P233, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
Reaction mass of 7-azatridecane-1,13-diamine and hexamethylenediamine	≥10 - ≤30	-
acetic acid	≥10 - ≤30	64-19-7
hexamethylenediamine	≥10 - ≤30	124-09-4
cyclohex-1,2-ylenediamine	≤10	694-83-7

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

Section 3. Composition and ingredient information

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Chemical burns must be treated promptly by a physician.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Get medical attention immediately. Call a poison center or physician. Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : May cause respiratory irritation.

Skin contact : Harmful in contact with skin. Causes skin irritation. May cause an allergic skin reaction.

Ingestion : Harmful if swallowed.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst. This material is harmful to aquatic life with long lasting effects. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Do not breathe vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities.

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not breathe vapour or mist. Do not ingest. Avoid release to the environment. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
acetic acid	**Safe Work Australia (Australia, 10/2022).** STEL: 37 mg/m³ 15 minutes. STEL: 15 ppm 15 minutes. TWA: 25 mg/m³ 8 hours. TWA: 10 ppm 8 hours.
hexamethylenediamine	**ACGIH TLV (United States, 1/2023).** TWA: 0.5 ppm 8 hours. TWA: 2.3 mg/m³ 8 hours.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Section 8. Exposure controls and personal protection

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): neoprene or PVC or Nitrile gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: half-face mask and organic vapour (Type A) and particulate filter

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid.

Colour : Amber. [Dark]

Odour : Pungent.

Odour threshold : Not available.

pH : 8 to 10

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : 100°C (212°F)

Flash point : Closed cup: >100°C (>212°F)

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Section 9. Physical and chemical properties and safety characteristics

Vapour pressure : Not available.

Relative vapour density : Not available.

Relative density : 1 to 1.1

Solubility(ies) :

Media	Result
cold water	Soluble
hot water	Soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : -27°C (-16.6°F)

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
MAX-GUARD™ PLUS	LD50 Oral	Rat	>500 mg/kg <1000	-
acetic acid	LD50 Dermal	Rabbit	1060 mg/kg	-
	LD50 Dermal	Rabbit	1060 uL/kg	-
	LD50 Oral	Mouse	4960 mg/kg	-
	LD50 Oral	Rat	3310 mg/kg	-
cyclohex-1,2-ylenediamine	LD50 Oral	Rat	4556 mg/kg	-

Conclusion/Summary : May be harmful if absorbed through skin or if swallowed. Can cause target organ damage.

Irritation/Corrosion

Skin : May cause skin irritation.

Eyes : Risk of serious damage to eyes. May cause eye burns and permanent eye injury.

Section 11. Toxicological information

Respiratory : May cause respiratory irritation. Inhalation of the spray or mist may produce severe irritation of respiratory tract, characterised by coughing, choking or shortness of breath.

Sensitisation

Skin : May cause sensitisation by skin contact. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Product/ingredient name	Category	Route of exposure	Target organs
MAX-GUARD™ PLUS	Category 3	-	Respiratory tract irritation
Reaction mass of 7-azatridecane-1,13-diamine and hexamethylenediamine	Category 3	-	Respiratory tract irritation
hexamethylenediamine	Category 3	-	Respiratory tract irritation
cyclohex-1,2-ylenediamine	Category 3	-	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : May cause respiratory irritation.

Skin contact : Harmful in contact with skin. Causes skin irritation. May cause an allergic skin reaction.

Ingestion : Harmful if swallowed.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Section 11. Toxicological information

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Product/ingredient name	Result	Species	Exposure
acetic acid	NOEC 1150 mg/l	Micro-organism	16 hours
	Acute EC50 >1000 mg/l	Algae	72 hours
	Acute EC50 73400 µg/l Fresh water	Algae - *Navicula seminulum*	96 hours
	Acute EC50 >1000 mg/l Fresh water	Daphnia	48 hours
	Acute EC50 65000 µg/l Fresh water	Daphnia - *Daphnia magna* - Neonate	48 hours
	Acute LC50 50.1 ul/L Marine water	Crustaceans - *Artemia sp.*	48 hours
	Acute LC50 >1000 mg/l	Fish	96 hours
	Acute LC50 251 ppm Fresh water	Fish - *Gambusia affinis* - Adult	96 hours
	Acute LC50 75000 µg/l Fresh water	Fish - *Lepomis macrochirus*	96 hours
	Acute LC50 88000 µg/l Fresh water	Fish - *Pimephales promelas* - Juvenile (Fledgling, Hatchling, Weanling)	96 hours

Persistence and degradability

Product/ingredient name	Test	Result	Dose	Inoculum
acetic acid	-	96 % - Readily - 20 days	-	-

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
MAX-GUARD™ PLUS	-	-	Not readily
acetic acid	-	-	Readily

Bioaccumulative potential

Section 12. Ecological information

Product/ingredient name	$LogP_{ow}$	BCF	Potential
acetic acid	-0.17	3.16	Low

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 2

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Section 16. Any other relevant information

Classification	Justification
ACUTE TOXICITY (oral) - Category 4	Expert judgment
ACUTE TOXICITY (dermal) - Category 4	Expert judgment
SKIN CORROSION/IRRITATION - Category 2	Expert judgment
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1	Expert judgment
SKIN SENSITISATION - Category 1	Expert judgment
SPECIFIC TARGET ORGAN TOXICITY - SINGLE EXPOSURE (Respiratory tract irritation) - Category 3	Expert judgment
LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 3	Expert judgment

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : MAX-GUARD™ E A

Product code : 9110DF

ADG : -

Product type : Liquid.

Identified uses : Shale Control Additive

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : ACUTE TOXICITY (oral) - Category 4
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2

GHS label elements

Hazard pictograms :



GHS08 GHS07

Signal word : WARNING

Hazard statements : H302 - Harmful if swallowed.
H373 - May cause damage to organs through prolonged or repeated exposure.

Section 2. Hazard(s) identification

Precautionary statements

Prevention : Do not breathe vapour. Do not eat, drink or smoke when using this product. Wash thoroughly after handling.

Response : Get medical advice/attention if you feel unwell.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P260, P270, P264, P314, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : Causes digestive tract burns.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
Poly[oxy(methyl-1,2-ethanediyl)], α-(2-aminomethylethyl)-ω-(2-aminomethylethoxy)-	≥10 - ≤30	9046-10-0
acetic acid	≥10 - ≤30	64-19-7

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention following exposure or if feeling unwell.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Continue to rinse for at least 10 minutes. Get medical attention following exposure or if feeling unwell. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : Harmful if swallowed. Corrosive to the digestive tract. Causes burns.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : Adverse symptoms may include the following:,stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Avoid breathing vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not breathe vapour or mist. Do not ingest. Avoid contact with eyes, skin and clothing. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
acetic acid	**Safe Work Australia (Australia, 10/2022).** STEL: 37 mg/m³ 15 minutes. STEL: 15 ppm 15 minutes. TWA: 25 mg/m³ 8 hours. TWA: 10 ppm 8 hours.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid. [Clear.]

Colour : Yellow. - Amber.

Odour : Characteristic.

Odour threshold : Not available.

pH : 6 to 6.5 [Conc. (% w/w): 1% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Vapour pressure : Not available.

Relative vapour density : Not available.

Relative density : 1 to 1.1

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Reactive or incompatible with the following materials: oxidising materials and acids.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
acetic acid	LC50 Inhalation Gas. LD50 Oral LD50 Oral	Mouse Mouse Rat	5620 ppm 4960 mg/kg 3310 mg/kg	1 hours - -

Conclusion/Summary : May be harmful if ingested. Can cause target organ damage.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Product/ingredient name	Category	Route of exposure	Target organs
MAX-GUARD™ E A	Category 2	-	-

Aspiration hazard

Product/ingredient name	Result
Poly[oxy(methyl-1,2-ethanediyl)], α-(2-aminomethylethyl)-ω-(2-aminomethylethoxy)-	ASPIRATION HAZARD - Category 1

Information on likely routes of exposure : Not available.

Section 11. Toxicological information

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : Harmful if swallowed. Corrosive to the digestive tract. Causes burns.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : Adverse symptoms may include the following:,stomach pains

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : May cause damage to organs through prolonged or repeated exposure.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Product/ingredient name	Result	Species	Exposure
acetic acid	Acute EC50 300.82 mg/l Marine water	Algae	72 hours
	Acute EC50 73400 µg/l Fresh water	Algae - *Navicula seminulum*	96 hours
	Acute EC50 300.82 mg/l Fresh water	Daphnia	48 hours
	Acute LC50 117.6 ul/L Marine water	Crustaceans - *Artemia sp.*	48 hours
	Acute LC50 300.82 mg/l Marine water	Fish	96 hours
	Acute LC50 79000 µg/l Fresh water	Fish - *Pimephales promelas* - Juvenile (Fledgling, Hatchling, Weanling)	96 hours

Persistence and degradability

Not available.

Section 12. Ecological information

Product/ingredient name	$LogP_{ow}$	BCF	Potential
acetic acid	-0.17	3.16	Low

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 13 May 2024.

Date of issue/Date of revision : 13 May 2024

Date of previous issue : No previous validation

Version : 1

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Section 16. Any other relevant information

Classification	Justification
ACUTE TOXICITY (oral) - Category 4 SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2	Expert judgment Expert judgment

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : MAX-GUARD™ PLUS A

Product code : 5044DF

ADG :

Product type : Liquid.

Identified uses : Shale Control Additive

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : SKIN CORROSION/IRRITATION - Category 1A
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1
SKIN SENSITISATION - Category 1

GHS label elements

Hazard pictograms :



GHS05 GHS07

Signal word : DANGER

Section 2. Hazard(s) identification

Hazard statements : H314 - Causes severe skin burns and eye damage.
H317 - May cause an allergic skin reaction.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Prevention : Wear protective gloves, protective clothing and eye or face protection. Avoid breathing vapour.

Response : IF INHALED: Immediately call a POISON CENTER or doctor. IF SWALLOWED: Immediately call a POISON CENTER or doctor. Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. Immediately call a POISON CENTER or doctor. Wash contaminated clothing before reuse. IF ON SKIN: Wash with plenty of water. If skin irritation or rash occurs: Get medical advice or attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor.

Storage : Store locked up.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : P103, P102, P101, P280, P261, P304 + P310, P301 + P310, P330, P331, P303 + P361 + P353, P310, P363, P302 + P352, P333 + P313, P305 + P351 + P338, P310, P405, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
1,2-Ethanediamine, N-(2-aminoethyl)-	≥10 - ≤30	111-40-0
acetic acid	≥10 - ≤30	64-19-7

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Chemical burns must be treated promptly by a physician.

Section 4. First aid measures

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Get medical attention immediately. Call a poison center or physician. Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Call a poison center or physician. Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Chemical burns must be treated promptly by a physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes severe burns. May cause an allergic skin reaction.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Section 5. Firefighting measures

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code :

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Do not breathe vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not breathe vapour or mist. Do not ingest. If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Section 7. Handling and storage

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
1,2-Ethanediamine, N-(2-aminoethyl)-	**Safe Work Australia (Australia, 1/2024). Absorbed through skin. Skin sensitiser. Inhalation sensitiser.** TWA: 4.2 mg/m³ 8 hours. TWA: 1 ppm 8 hours.
acetic acid	**Safe Work Australia (Australia, 1/2024).** STEL: 37 mg/m³ 15 minutes. STEL: 15 ppm 15 minutes. TWA: 25 mg/m³ 8 hours. TWA: 10 ppm 8 hours.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Section 8. Exposure controls and personal protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid.

Colour : Light Amber to pale yellow. [Transparent]

Odour : Ammonia-like. [Slight]

Odour threshold : Not available.

pH : 8 to 10

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: >100°C (>212°F)

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Vapour pressure : Not available.

Relative vapour density : Not available.

Relative density : 1.05 to 1.15

Not Available.

Miscible with water : Yes.

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Section 9. Physical and chemical properties and safety characteristics

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Reactive or incompatible with the following materials: oxidising materials, metals, acids and alkalis.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
1,2-Ethanediamine, N-(2-aminoethyl)-	LD50 Dermal	Rabbit	1090 mg/kg	-
	LD50 Oral	Rat	1080 mg/kg	-
acetic acid	LD50 Dermal	Rabbit	1060 mg/kg	-
	LD50 Dermal	Rabbit	1060 uL/kg	-
	LD50 Oral	Mouse	4960 mg/kg	-
	LD50 Oral	Rat	3310 mg/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : Causes pain and burns in contact with skin. May cause permanent skin damage.

Eyes : Risk of serious damage to eyes. May cause eye burns and permanent eye injury.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : May cause sensitisation by skin contact. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Section 11. Toxicological information

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes severe burns. May cause an allergic skin reaction.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Product/ingredient name	Result	Species	Exposure
1,2-Ethanediamine, N-(2-aminoethyl)-	Acute EC50 345600 µg/l Fresh water	Algae - *Pseudokirchneriella subcapitata*	96 hours
	Acute LC50 53500 µg/l Fresh water	Daphnia - *Daphnia magna*	48 hours
	Acute LC50 1014000 µg/l Fresh water	Fish - *Poecilia reticulata*	96 hours
acetic acid	NOEC 1150 mg/l	Micro-organism	16 hours
	Acute EC50 >1000 mg/l	Algae	72 hours
	Acute EC50 73400 µg/l Fresh water	Algae - *Navicula seminulum*	96 hours
	Acute EC50 >1000 mg/l Fresh water	Daphnia	48 hours
	Acute EC50 65000 µg/l Fresh water	Daphnia - *Daphnia magna* - Neonate	48 hours
	Acute LC50 50.1 ul/L Marine water	Crustaceans - *Artemia sp.*	48 hours
	Acute LC50 >1000 mg/l	Fish	96 hours
	Acute LC50 251 ppm Fresh water	Fish - *Gambusia affinis* - Adult	96 hours
	Acute LC50 75000 µg/l Fresh water	Fish - *Lepomis macrochirus*	96 hours
	Acute LC50 88000 µg/l Fresh water	Fish - *Pimephales promelas* - Juvenile (Fledgling, Hatchling, Weanling)	96 hours

Persistence and degradability

Not available.

Product/ingredient name	Test	Result	Dose	Inoculum
acetic acid	-	96 % - Readily - 20 days	-	-

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
acetic acid	-	-	Readily

Product/ingredient name	$LogP_{ow}$	BCF	Potential
1,2-Ethanediamine, N-(2-aminoethyl)-	-5.58	2.8 to 6.3	Low
acetic acid	-0.17	3.16	Low

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code -
ADG Class	No.	Hazchem code -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Section 15. Regulatory information

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 24 October 2024.

Date of issue/Date of revision : 24 October 2024

Date of previous issue : 30 August 2024

Version : 2

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
SKIN CORROSION/IRRITATION - Category 1A	Expert judgment
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1	Expert judgment
SKIN SENSITISATION - Category 1	Expert judgment

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

MAX-SHIELD™

Version 4

Section 1. Identification

Product identifier : MAX-SHIELD™

Product code : 1147DF

ADG : -

Product type : Liquid.

Identified uses : BOREHOLE SEALANT

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

There are no ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Section 4. First aid measures

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides,sulfur oxides,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Additional information

Protect from freezing. Do not store below the following temperature:0°C

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): nitrile or neoprene Gloves

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid. [Hazy liquid.]

Colour : White.

Odour : Slight

Odour threshold : Not available.

pH : 6 to 10

Melting point/freezing point : 0°C

Boiling point or initial boiling point and boiling range : 100°C (212°F)

Flash point : Not available.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Vapour pressure : 2.3 kPa (17.5 mm Hg)

Relative vapour density : Not available.

Relative density : 1.015 to 1.05 (20°C)

Solubility(ies) :

Media	Result
cold water	Soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Respiratory or skin sensitization

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Germ cell mutagenicity

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure

Not available.

Product/ingredient name	Result
Not available.	

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Product/ingredient name	Result
Not available.	

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Product/ingredient name	Oral (mg/kg)	Dermal (mg/kg)	Inhalation (gases) (ppm)	Inhalation (vapours) (mg/l)	Inhalation (dusts and mists) (mg/l)
N/A					

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Not available.

Persistence and degradability

Product/ingredient name	Result
Not available.	

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Not available.			

Bioaccumulative potential

Section 12. Ecological information

Not available.

Mobility in soil

Soil/water partition coefficient : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	-
ADG Class	No.	-
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

7, 5

Model Work Health and Safety Regulations - Scheduled Substances

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 2 June 2025.

Date of issue/Date of revision : 2 June 2025

Date of previous issue : 23 February 2024

Version : 4

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Section 16. Any other relevant information

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : MIL-BAR™

Product code : 1151DF

ADG : -

Product type : Powder.

Identified uses : Weighting Agent

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : CARCINOGENICITY - Category 1
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2

GHS label elements

Hazard pictograms :



GHS08

Signal word : DANGER

Section 2. Hazard(s) identification

Hazard statements : H350 - May cause cancer.
H373 - May cause damage to organs through prolonged or repeated exposure. (lungs)

Precautionary statements

Prevention : Obtain special instructions before use. Wear protective gloves: > 8 hours (breakthrough time): Nitrile gloves. or Neoprene gloves.. Wear protective clothing. Wear eye or face protection. Wear hearing protection. Do not breathe dust or mist.

Response : IF exposed or concerned: Get medical advice or attention.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P201, P280, P260, P308 + P313, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
crystalline silica, respirable powder	<10	14808-60-7
Mica-group minerals	≤3	12001-26-2

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : sulfur oxides,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe dust. Do not ingest. If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
crystalline silica, respirable powder	**Safe Work Australia (Australia, 4/2018).** TWA: 0.1 mg/m³ 8 hours. Form: Respirable dust
Mica-group minerals	**Safe Work Australia (Australia, 10/2022).** TWA: 2.5 mg/m³ 8 hours. Form: Inspirable

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): Nitrile gloves. or Neoprene gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: Wear a respirator conforming to EN140 with type A/P2 filter or better.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Tan. to Brown.

Odour : Odourless.

Odour threshold : Not available.

pH : 7 [Conc. (% w/w): 2% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 4 to 4.5 (20°C)

Solubility(ies) :

Media	Result
cold water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Product/ingredient name	Category	Route of exposure	Target organs
crystalline silica, respirable powder	Category 1	inhalation	lungs

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Section 11. Toxicological information

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : May cause damage to organs through prolonged or repeated exposure. Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	

Section 14. Transport information

IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Ingredient name	Schedule
crystalline silica, respirable powder	Restricted hazardous chemical [For abrasive blasting at a concentration of greater than 1%]

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Section 15. Regulatory information

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 4

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
CARCINOGENICITY - Category 1	Calculation method
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : MIL-BIO SEA 98

Product code : 1658DF

ADG : -

Product type : Liquid.

Identified uses : Biocide

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : ACUTE TOXICITY (oral) - Category 4
ACUTE TOXICITY (inhalation) - Category 4
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1
SKIN SENSITISATION - Category 1
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2
SHORT-TERM (ACUTE) AQUATIC HAZARD - Category 2
LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 3

GHS label elements

Hazard pictograms :



Section 2. Hazard(s) identification

GHS05 GHS08 GHS07

Signal word : DANGER

Hazard statements : H302 + H332 - Harmful if swallowed or if inhaled.
H317 - May cause an allergic skin reaction.
H318 - Causes serious eye damage.
H373 - May cause damage to organs through prolonged or repeated exposure.
H401 - Toxic to aquatic life.
H412 - Harmful to aquatic life with long lasting effects.

Precautionary statements

Prevention : Wear protective gloves: > 8 hours (breakthrough time): Nitrile gloves. Neoprene gloves.. Wear eye or face protection: Recommended: Chemical splash goggles.. Avoid release to the environment. Do not breathe vapour. Do not eat, drink or smoke when using this product. Wash thoroughly after handling.

Response : Get medical advice/attention if you feel unwell. IF INHALED: Call a POISON CENTER or doctor if you feel unwell. Take off contaminated clothing and wash it before reuse. IF ON SKIN: Wash with plenty of water. If skin irritation or rash occurs: Get medical advice or attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P280, P273, P260, P270, P264, P314, P304 + P312, P362 + P364, P302 + P352, P333 + P313, P305 + P351 + P338, P310, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
THPS	≥10 - <25	55566-30-8

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Chemical burns must be treated promptly by a physician.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Get medical attention immediately. Call a poison center or physician. Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : Harmful if inhaled.

Skin contact : May cause an allergic skin reaction.

Ingestion : Harmful if swallowed.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst. This material is toxic to aquatic life. This material is harmful to aquatic life with long lasting effects. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,sulfur oxides,phosphorus oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Do not breathe vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities.

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not breathe vapour or mist. Do not ingest. Avoid release to the environment. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
THPS	**ACGIH TLV (United States, 1/2023). Skin sensitiser.** TWA: 2 mg/m³ 8 hours.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Section 8. Exposure controls and personal protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): Nitrile gloves. Neoprene gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: If necessary half-face mask and organic vapour filter (Type A)

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid.

Colour : Colourless to light yellow.

Odour : Characteristic.

Odour threshold : Not available.

pH : 3 to 7

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : 108.5°C (227.3°F)

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Vapour pressure : Not available.

Relative vapour density : Not available.

Relative density : 1.1 (20°C)

Solubility(ies) :

Media	Result
cold water	Soluble

Section 9. Physical and chemical properties and safety characteristics

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
THPS	LC50 Inhalation Dusts and mists	Rat	0.591 mg/l @ 75% THPS (Aqueous solution)	4 hours
	LD50 Dermal	Rat	>2000 mg/kg (75% solution)	-
	LD50 Oral	Rat	575 mg/kg (75% solution)	-

Conclusion/Summary : Harmful if inhaled. May be harmful if ingested. Can cause target organ damage. Adverse health effects could include the following: breathing difficulty or shortness of breath

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : Risk of serious damage to eyes. May cause eye burns and permanent eye injury.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : May cause sensitisation by skin contact. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Section 11. Toxicological information

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Product/ingredient name	Category	Route of exposure	Target organs
THPS	Category 2	oral	-

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : Harmful if inhaled.

Skin contact : May cause an allergic skin reaction.

Ingestion : Harmful if swallowed.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : May cause damage to organs through prolonged or repeated exposure. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 11. Toxicological information

Section 12. Ecological information

Toxicity : Toxic to aquatic organisms. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Product/ingredient name	Result	Species	Exposure
THPS	Acute EC50 0.66 mg/l	Algae	96 hours
	Acute EC50 15.1 mg/l	Daphnia	48 hours
	Acute LC50 95 mg/l	Fish	96 hours
	Chronic NOEC 0.064 mg/l	Algae	96 hours
	Chronic NOEC 0.032 mg/l	Daphnia	21 days
	Chronic NOEC 1.1 mg/l	Fish	32 days

Persistence and degradability

Not available.

Product/ingredient name	Test	Result	Dose	Inoculum
THPS	-	70 % - Readily - 21 days	-	-

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
THPS	-	-	Readily

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Section 14. Transport information

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code -
ADG Class	No.	Hazchem code -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 4

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
ACUTE TOXICITY (oral) - Category 4	Calculation method
ACUTE TOXICITY (inhalation) - Category 4	Calculation method
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1	Calculation method
SKIN SENSITISATION - Category 1	Calculation method
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2	Calculation method
SHORT-TERM (ACUTE) AQUATIC HAZARD - Category 2	Calculation method
LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 3	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : MIL-CARB™ SERIES

Product code : 1867DF

ADG : -

Product type : Powder.

Identified uses : Lost Circulation Material

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : CARCINOGENICITY - Category 1
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2

GHS label elements

Hazard pictograms :



GHS08

Signal word : DANGER

Section 2. Hazard(s) identification

Hazard statements : H350 - May cause cancer.
H373 - May cause damage to organs through prolonged or repeated exposure. (lungs)

Precautionary statements

Prevention : Obtain special instructions before use. Wear protective gloves: > 8 hours (breakthrough time): nitrile Gloves. Wear protective clothing. Wear eye or face protection. Wear hearing protection. Do not breathe dust or mist.

Response : IF exposed or concerned: Get medical advice or attention.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P201, P280, P260, P308 + P313, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
Limestone	60 - 100	1317-65-3
crystalline silica, respirable powder	1 - 5	14808-60-7

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe dust. Do not ingest. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Limestone	**EH40/2005 WELs (United Kingdom (UK), 8/2018).** TWA: 10 mg/m³ 8 hours. Form: inhalable dust TWA: 4 mg/m³ 8 hours. Form: respirable dust
crystalline silica, respirable powder	**Safe Work Australia (Australia, 4/2018).** TWA: 0.1 mg/m³ 8 hours. Form: Respirable dust

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): nitrile Gloves

Section 8. Exposure controls and personal protection

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: half-face mask and particulate filter

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : White.

Odour : Odourless.

Odour threshold : Not available.

pH : 8.5 [Conc. (% w/w): 5% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : Not available.

Solubility(ies) :

Media	Result
cold water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Section 9. Physical and chemical properties and safety characteristics

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Product/ingredient name	Category	Route of exposure	Target organs
crystalline silica, respirable powder	Category 1	inhalation	lungs

Aspiration hazard

Not available.

Section 11. Toxicological information

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : May cause damage to organs through prolonged or repeated exposure. Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	-
ADG Class	No.	-
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Ingredient name	Schedule
crystalline silica, respirable powder	Restricted hazardous chemical [For abrasive blasting at a concentration of greater than 1%]

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

Section 15. Regulatory information

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 2

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
CARCINOGENICITY - Category 1	Calculation method
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : MIL-GARD™ XPR

Product code : 2951DF

ADG : TOXIC LIQUID, ORGANIC, N.O.S. (1,3,5-tris(hydroxyethyl)hexahydrotriazine solution)

Product type : Liquid.

Identified uses : Hydrogen Sulfide Scavenger.

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : ACUTE TOXICITY (oral) - Category 4
ACUTE TOXICITY (inhalation) - Category 3
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A
SKIN SENSITISATION - Category 1
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 1

GHS label elements

Hazard pictograms :



GHS06 GHS08

Section 2. Hazard(s) identification

Signal word : DANGER

Hazard statements : H302 - Harmful if swallowed.
H317 - May cause an allergic skin reaction.
H319 - Causes serious eye irritation.
H331 - Toxic if inhaled.
H372 - Causes damage to organs through prolonged or repeated exposure.

Precautionary statements

Prevention : Wear protective gloves: > 8 hours (breakthrough time): Nitrile gloves.. Wear eye or face protection: Recommended: face shield and Chemical splash goggles.. Do not breathe vapour. Do not eat, drink or smoke when using this product. Wash thoroughly after handling.

Response : Get medical advice/attention if you feel unwell. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor. Take off contaminated clothing and wash it before reuse. IF ON SKIN: Wash with plenty of water. If skin irritation or rash occurs: Get medical advice or attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice or attention.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P280, P260, P270, P264, P314, P304 + P340, P311, P362 + P364, P302 + P352, P333 + P313, P305 + P351 + P338, P337 + P313, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
2,2',2"-(hexahydro-1,3,5-triazine-1,3,5-triyl)triethanol; 1,3,5-tris (2-hydroxyethyl)hexahydro-1,3,5-triazine	≥30 - ≤55	4719-04-4

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Section 4. First aid measures

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Toxic if inhaled.

Skin contact : May cause an allergic skin reaction.

Ingestion : Harmful if swallowed.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain or irritation,watering,redness

Inhalation : No specific data.

Skin contact : irritation,redness

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides

Section 5. Firefighting measures

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : 2X

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Do not breathe vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not breathe vapour or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): Nitrile gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Recommended: chemical-resistant protective suit

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: half-face mask organic vapour (Type A) and acid gas (Type E) filter

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid.

Colour : Amber.

Odour : Amine-like.

Odour threshold : Not available.

pH : 10 to 12.5

Melting point/freezing point : <-20°C

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: >101°C (>213.8°F)

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Vapour pressure : Not available.

Relative vapour density : Not available.

Relative density : 1.065 to 1.135 (16°C)

Solubility(ies) :

Media	Result
cold water	Partially soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Kinematic (40°C): <10 cSt

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
2,2',2"-(hexahydro-1,3,5-triazine-1,3,5-triyl) triethanol; 1,3,5-tris (2-hydroxyethyl)hexahydro-1,3,5-triazine	LC50 Inhalation Dusts and mists	Rat	0.371 mg/l Aerosol.@75%	4 hours
	LD50 Dermal	Rat	>4000 mg/kg	-
	LD50 Oral	Rat	1000 mg/kg	-

Conclusion/Summary : May be toxic if inhaled. May be harmful if ingested. Can cause target organ damage. Adverse health effects could include the following: breathing difficulty or shortness of breath

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : May cause eye irritation.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : May cause sensitisation by skin contact. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Product/ingredient name	Category	Route of exposure	Target organs
2,2',2"-(hexahydro-1,3,5-triazine-1,3,5-triyl)triethanol; 1,3,5-tris(2-hydroxyethyl)hexahydro-1,3,5-triazine	Category 1	inhalation	-

Aspiration hazard

Section 11. Toxicological information

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Toxic if inhaled.

Skin contact : May cause an allergic skin reaction.

Ingestion : Harmful if swallowed.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain or irritation,watering,redness

Inhalation : No specific data.

Skin contact : irritation,redness

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Causes damage to organs through prolonged or repeated exposure. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
2,2',2"-(hexahydro-1,3,5-triazine-1,3,5-triyl) triethanol; 1,3,5-tris (2-hydroxyethyl)hexahydro-1,3,5-triazine	Acute EC50 6.7 mg/l Fresh water	Algae	72 hours
	Acute EC50 11.9 mg/l Fresh water	Daphnia	48 hours
	Acute LC50 16 mg/l Fresh water	Fish	96 hours

Persistence and degradability

Section 12. Ecological information

Product/ingredient name	Test	Result	Dose	Inoculum
2,2',2''-(hexahydro-1,3,5-triazine-1,3,5-triyl) triethanol; 1,3,5-tris (2-hydroxyethyl)hexahydro-1,3,5-triazine	-	100 % - Readily - 1 days	-	-

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
2,2',2''-(hexahydro-1,3,5-triazine-1,3,5-triyl) triethanol; 1,3,5-tris (2-hydroxyethyl)hexahydro-1,3,5-triazine	-	-	Readily

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
2,2',2''-(hexahydro-1,3,5-triazine-1,3,5-triyl) triethanol; 1,3,5-tris (2-hydroxyethyl)hexahydro-1,3,5-triazine	-2	-	Low

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	UN2810	TOXIC LIQUID, ORGANIC, N. O.S. (1,3,5-tris(hydroxyethyl) hexahydrotriazine solution)	6.1	II	
ADG	UN2810	TOXIC LIQUID, ORGANIC, N. O.S. (1,3,5-tris(hydroxyethyl) hexahydrotriazine solution)	6.1	II	
IMDG	UN2810	TOXIC LIQUID, ORGANIC, N. O.S.(1,3,5-tris(hydroxyethyl) hexahydrotriazine solution)	6.1	II	
IATA	UN2810	TOXIC LIQUID, ORGANIC, N. O.S.(1,3,5-tris(hydroxyethyl) hexahydrotriazine solution)	6.1	II	

PG* : Packing group

Section 14. Transport information

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Tunnel code** (D/E) **Hazchem code** 2X
ADG Class	No.	**Hazchem code** 2X
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 4

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
ACUTE TOXICITY (oral) - Category 4	Calculation method
ACUTE TOXICITY (inhalation) - Category 3	Calculation method
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A	Calculation method
SKIN SENSITISATION - Category 1	Calculation method
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 1	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : MILGEL™ NT

Product code : 4018DF

ADG : -

Product type : Powder.

Identified uses : Viscosifier

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : CARCINOGENICITY - Category 1
SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2

GHS label elements

Hazard pictograms :



GHS08

Signal word : DANGER

Section 2. Hazard(s) identification

Hazard statements : H350 - May cause cancer.
H373 - May cause damage to organs through prolonged or repeated exposure. (lungs)

Precautionary statements

Prevention : Obtain special instructions before use. Wear protective gloves: > 8 hours (breakthrough time): nitrile or neoprene. Wear protective clothing. Wear eye or face protection. Wear hearing protection. Do not breathe dust or mist.

Response : IF exposed or concerned: Get medical advice or attention.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P201, P280, P260, P308 + P313, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
Bentonite	60 - 100	1302-78-9
crystalline silica, respirable powder	1 - 5	14808-60-7

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 5. Firefighting measures

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe dust. Do not ingest. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
crystalline silica, respirable powder	**Safe Work Australia (Australia, 4/2018).** TWA: 0.1 mg/m³ 8 hours. Form: Respirable dust

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): nitrile or neoprene

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: Wear a respirator conforming to EN140 with type A/P2 filter or better.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Beige.

Odour : Odourless.

Odour threshold : Not available.

pH : 7 [Conc. (% w/w): 1% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 2.4 to 2.5

Solubility(ies) :

Media	Result
cold water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Section 9. Physical and chemical properties and safety characteristics

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Product/ingredient name	Category	Route of exposure	Target organs
crystalline silica, respirable powder	Category 1	inhalation	lungs

Aspiration hazard

Not available.

Section 11. Toxicological information

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : May cause damage to organs through prolonged or repeated exposure. Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
Bentonite	Acute LC50 19000000 µg/l Fresh water	Fish - *Oncorhynchus mykiss*	96 hours

Conclusion/Summary : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code -
ADG Class	No.	Hazchem code -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Section 15. Regulatory information

Ingredient name	Schedule
crystalline silica, respirable powder	Restricted hazardous chemical [For abrasive blasting at a concentration of greater than 1%]

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 7

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Section 16. Any other relevant information

Classification	Justification
CARCINOGENICITY - Category 1 SPECIFIC TARGET ORGAN TOXICITY - REPEATED EXPOSURE - Category 2	Calculation method Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : MIL-LIME™

Product code : 5025DF

ADG : -

Other means of identification : calcium hydroxide, lime

Product type : Solid.

Identified uses : Alkalinity Control

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1
SPECIFIC TARGET ORGAN TOXICITY - SINGLE EXPOSURE (Respiratory tract irritation) - Category 3

GHS label elements

Hazard pictograms :



GHS05 GHS07

Section 2. Hazard(s) identification

Signal word : DANGER

Hazard statements : H315 - Causes skin irritation.
H318 - Causes serious eye damage.
H335 - May cause respiratory irritation.

Precautionary statements

Prevention : Wear protective gloves: > 8 hours (breakthrough time): Nitrile gloves. or Neoprene gloves.. Wear eye or face protection. Avoid breathing dust. Wash thoroughly after handling.

Response : IF INHALED: Call a POISON CENTER or doctor if you feel unwell. Take off contaminated clothing and wash it before reuse. IF ON SKIN: Wash with plenty of water. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor.

Storage : Store in a well-ventilated place. Keep container tightly closed.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P280, P261, P264, P304 + P312, P362 + P364, P302 + P352, P305 + P351 + P338, P310, P403 + P233, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Other means of identification : calcium hydroxide, lime

Ingredient name	% (w/w)	CAS number
calcium dihydroxide	60 - 100	1305-62-0

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Chemical burns must be treated promptly by a physician.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Section 4. First aid measures

Skin contact : Get medical attention immediately. Call a poison center or physician. Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : May cause respiratory irritation.

Skin contact : Causes skin irritation.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Section 5. Firefighting measures

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Avoid dust generation. Using a vacuum with HEPA filter will reduce dust dispersal. Place spilled material in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not get in eyes or on skin or clothing. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
calcium dihydroxide	**Safe Work Australia (Australia, 10/2022).** TWA: 5 mg/m³ 8 hours.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): Nitrile gloves. or Neoprene gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: If necessary Wear a respirator conforming to EN140 with type A/P2 filter or better.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Crystalline solid.]

Colour : White.

Odour : Odourless.

Odour threshold : Not available.

pH : 12.4 [Conc. (% w/w): 10% - (H2O)]

Melting point/freezing point : 580°C

Boiling point, initial boiling point, and boiling range : 2850°C (5162°F)

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 2.2 to 2.4

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
calcium dihydroxide	LD50 Oral	Rat	7340 mg/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : May cause skin irritation.

Eyes : Risk of serious damage to eyes. May cause eye burns and permanent eye injury.

Respiratory : May cause respiratory irritation. Inhalation of the spray or mist may produce severe irritation of respiratory tract, characterised by coughing, choking or shortness of breath.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Product/ingredient name	Category	Route of exposure	Target organs
MIL-LIME™	Category 3	-	Respiratory tract irritation
calcium dihydroxide	Category 3	-	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Section 11. Toxicological information

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : May cause respiratory irritation.

Skin contact : Causes skin irritation.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
calcium dihydroxide	Acute LC50 112.89 ppm Marine water	Crustaceans - *Mysidopsis juniae*	96 hours
	Acute LC50 160 ppm Fresh water	Fish - *Gambusia affinis* - Adult	96 hours
	Acute LC50 457 mg/l Marine water	Fish - *Gasterosteus aculeatus*	96 hours
	Chronic LOEL 125 ppm Marine water	Echinodermata - *Lytechinus variegatus*	-
	Chronic NOEC 62.5 ppm Marine water	Echinodermata - *Lytechinus variegatus*	-

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

Section 15. Regulatory information

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 3

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
SKIN CORROSION/IRRITATION - Category 2	Expert judgment
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1	Expert judgment
SPECIFIC TARGET ORGAN TOXICITY - SINGLE EXPOSURE (Respiratory tract irritation) - Category 3	Expert judgment

References : Not available.

Indicates information that has changed from previously issued version.

Section 16. Any other relevant information

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

MIL-PAC™ LV

Version 4

Section 1. Identification

Product identifier : MIL-PAC™ LV

Product code : 5201DF

ADG : -

Product type : Powder.

Identified uses : Filtration Control Agent

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
Cellulose, carboxymethyl ether, sodium salt	≥90	9004-32-4

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Section 4. First aid measures

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,halogenated compounds,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 6. Accidental release measures

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid breathing dust. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Section 8. Exposure controls and personal protection

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): Nitrile gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: If necessary half-face mask and particulate filter

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Off-white. to Yellow.

Odour : Odourless.

Odour threshold : Not available.

pH : 6 to 8.5 [Conc. (% w/w): 10% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 0.5 to 0.75

Solubility(ies) :

Media	Result
cold water	Soluble

Partition coefficient: n-octanol/water : Not applicable.

Section 9. Physical and chemical properties and safety characteristics

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Reactive or incompatible with the following materials: oxidising materials and reducing materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Cellulose, carboxymethyl ether, sodium salt	LD50 Oral	Rat	27000 mg/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Section 11. Toxicological information

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
Cellulose, carboxymethyl ether, sodium salt	Acute EC50 87.26 mg/l Fresh water	Crustaceans - *Ceriodaphnia dubia* - Neonate	48 hours
	Acute LC50 >20000000 µg/l Fresh water	Fish - *Oncorhynchus mykiss*	96 hours

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Section 14. Transport information

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 25 March 2024.

Date of issue/Date of revision : 25 March 2024

Date of previous issue : 23 February 2024

Version : 4

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Section 16. Any other relevant information

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

MILSTARCH™

Version 1

Section 1. Identification

Product identifier : MILSTARCH™

Product code : 1155DF

ADG : -

Product type : Powder.

Identified uses : Filtration Control Agent

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
Starch	60 - 100	9005-25-8

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Section 4. First aid measures

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 6. Accidental release measures

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid breathing dust. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Starch	**Safe Work Australia (Australia, 10/2022).** TWA: 10 mg/m³ 8 hours.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Section 8. Exposure controls and personal protection

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): nitrile or neoprene Gloves

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: If necessary half-face mask and particulate filter

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Off-white.

Odour : Not available.

Odour threshold : Not available.

pH : 5.6 to 8 [Conc. (% w/w): 10% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: >125°C (>257°F)

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 0.55 to 0.7 (20°C)

Solubility(ies) :

Section 9. Physical and chemical properties and safety characteristics

Media	Result
cold water	Easily soluble
hot water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Reactive or incompatible with the following materials: oxidising materials and moisture.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Section 11. Toxicological information

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 2 May 2024.

Date of issue/Date of revision : 2 May 2024

Date of previous issue : No previous validation

Version : 1

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

Section 16. Any other relevant information

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

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Section 1. Identification

Product identifier : MIL-TEMP™

Product code : 1468DF

ADG : -

Product type : Powder.

Identified uses : Deflocculant

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : SKIN SENSITISATION - Category 1
LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 3

GHS label elements

Hazard pictograms :



GHS07

Signal word : WARNING

Hazard statements : H317 - May cause an allergic skin reaction.
H412 - Harmful to aquatic life with long lasting effects.

Section 2. Hazard(s) identification

Precautionary statements

Prevention : Wear protective gloves. Avoid release to the environment. Avoid breathing dust or mist.

Response : Take off contaminated clothing and wash it before reuse. IF ON SKIN: Wash with plenty of water. If skin irritation or rash occurs: Get medical advice or attention.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P280, P273, P261, P362 + P364, P302 + P352, P333 + P313, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
reaction mass of: 5-chloro-2-methyl-4-isothiazolin-3-one and 2-methyl-2H - isothiazol-3-one (3:1)	≤0.1	55965-84-9

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. In the event of any complaints or symptoms, avoid further exposure. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Section 4. First aid measures

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : May cause an allergic skin reaction.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : irritation,redness

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed. This material is harmful to aquatic life with long lasting effects. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities.

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Avoid dust generation. Using a vacuum with HEPA filter will reduce dust dispersal. Place spilled material in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing dust. Avoid release to the environment. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Tan.

Odour : Odourless.

Odour threshold : Not available.

pH : 7 [Conc. (% w/w): 1% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 0.93 to 0.95 (20°C)

Solubility(ies) :

Media	Result
cold water	Easily soluble
hot water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
reaction mass of: 5-chloro-2-methyl-4-isothiazolin-3-one and 2-methyl-2H -isothiazol-3-one (3:1)	LC50 Inhalation Dusts and mists	Rat	0.33 mg/l	4 hours

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : May cause sensitisation by skin contact. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Section 11. Toxicological information

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : May cause an allergic skin reaction.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : irritation,redness

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Product/ingredient name	Result	Species	Exposure
reaction mass of: 5-chloro-2-methyl-4-isothiazolin-3-one and 2-methyl-2H -isothiazol-3-one (3:1)	EC50 0.027 mg/l	Algae	72 hours

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

Section 15. Regulatory information

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 2

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
SKIN SENSITISATION - Category 1	Calculation method
LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 3	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

Section 16. Any other relevant information

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

NANOSHIELD™

Version
3.01

Section 1. Identification

Product identifier : NANOSHIELD™

Product code : 7223DF

ADG : -

Product type : Powder.

Identified uses : Wellbore Stabilizer and Borehole Sealant

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
Silica gel, pptd., cryst.-free	≤5	112926-00-8

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Section 4. First aid measures

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : No specific data.

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 6. Accidental release measures

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid breathing dust. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Silica gel, pptd., cryst.-free	**Safe Work Australia (Australia, 10/2022). [Precipitated silica]** TWA: 10 mg/m³ 8 hours.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Section 8. Exposure controls and personal protection

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): Nitrile gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: If necessary half-face mask and particulate filter

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Yellow. [Light]

Odour : Odourless.

Odour threshold : Not available.

pH : Not available.

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : Not available.

Solubility(ies) :

Section 9. Physical and chemical properties and safety characteristics

Media	Result
cold water	Not soluble
hot water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Extremely explosive in the presence of the following materials or conditions: combustible materials.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Additional information : Dust deflagration index (Kst): 122 m.b_/s

Dust explosion class: St1

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Reactive or incompatible with the following materials: moisture.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Section 11. Toxicological information

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 7 May 2024.

Date of issue/Date of revision : 7 May 2024

Date of previous issue : 23 February 2024

Version : 3.01

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

Section 16. Any other relevant information

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

NEW-DRILL™ PLUS

Version 3

Section 1. Identification

Product identifier : NEW-DRILL™ PLUS

Product code : 1072DF

ADG : -

Product type : Solid.

Identified uses : Deflocculant

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
2-Propenoic acid, polymer with 2-propenamide, sodium salt	60 - 100	25987-30-8

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Section 4. First aid measures

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Additional information

Product forms slippery surface when combined with water.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 6. Accidental release measures

Additional information

Product forms slippery surface when combined with water.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Additional information

Product forms slippery surface when combined with water.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): Nitrile gloves. Neoprene gloves.

Section 8. Exposure controls and personal protection

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Granular solid.]

Colour : White.

Odour : Odourless.

Odour threshold : Not available.

pH : 5 to 9 [Conc. (% w/w): 5% - (H2O)]

Melting point/freezing point : >150°C

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: >100°C (>212°F)

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 0.6 to 0.9

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : -2

Auto-ignition temperature : Not applicable.

Decomposition temperature : >150°C

Viscosity : Not available.

Explosive properties : Not available.

Section 9. Physical and chemical properties and safety characteristics

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Section 11. Toxicological information

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Product/ingredient name	$LogP_{ow}$	BCF	Potential
NEW-DRILL™ PLUS	-2	-	Low

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Section 15. Regulatory information

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 3

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

NEW-DRILL™ LV

Version 2

Section 1. Identification

Product identifier : NEW-DRILL™ LV

Product code : 1086DF

ADG : -

Product type : Solid.

Identified uses : Deflocculant

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
2-Propenoic acid, polymer with 2-propenamide, sodium salt	60 - 100	25987-30-8

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Section 4. First aid measures

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): Nitrile gloves. Neoprene gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Granular solid.]

Colour : White.

Odour : Odourless.

Odour threshold : Not available.

pH : 5 to 9 [Conc. (% w/w): 5% - (H2O)]

Melting point/freezing point : >150°C

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: >100°C (>212°F)

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 0.6 to 0.9

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : -2

Auto-ignition temperature : Not applicable.

Decomposition temperature : >150°C

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Section 11. Toxicological information

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Product/ingredient name	$LogP_{ow}$	BCF	Potential
NEW-DRILL™ LV	-2	-	Low

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Section 14. Transport information

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code -
ADG Class	No.	Hazchem code -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 2

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : NOXYGEN™ L

Product code : 1315DF

ADG : BISULFITES, AQUEOUS SOLUTION, N.O.S.

Product type : Liquid.

Identified uses : Oxygen scavenger.

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : ACUTE TOXICITY (oral) - Category 4
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1

GHS label elements

Hazard pictograms :



GHS05 GHS07

Signal word : DANGER

Hazard statements : H302 - Harmful if swallowed.
H318 - Causes serious eye damage.

Section 2. Hazard(s) identification

Precautionary statements

Prevention : Wear eye or face protection. Do not eat, drink or smoke when using this product. Wash thoroughly after handling.

Response : IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P280, P270, P264, P305 + P351 + P338, P310, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
ammonium hydrogensulphite	≥30 - ≤60	10192-30-0

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Chemical burns must be treated promptly by a physician.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Get medical attention immediately. Call a poison center or physician. Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : Harmful if swallowed.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : nitrogen oxides,sulfur oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : 2W

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Do not breathe vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not get in eyes or on skin or clothing. Do not breathe vapour or mist. Do not ingest. If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): PVC, neoprene or Rubber gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid. [Clear.]

Colour : Yellow. [Light]

Odour : Pungent.

Odour threshold : Not available.

pH : 4.5 to 5.5

Melting point/freezing point : <0°C

Boiling point, initial boiling point, and boiling range : 105°C (221°F)

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Vapour pressure : 0.43 kPa (3.2 mm Hg)

Relative vapour density : Not available.

Relative density : 1.3 to 1.4 (20°C)

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Explosive in the presence of the following materials or conditions: oxidising materials.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Extremely reactive or incompatible with the following materials: oxidising materials, acids and alkalis.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : May be harmful if ingested. Can cause target organ damage.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : Risk of serious damage to eyes. May cause eye burns and permanent eye injury.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : Harmful if swallowed.

Symptoms related to the physical, chemical and toxicological characteristics

Section 11. Toxicological information

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	UN2683	BISULFITES, AQUEOUS SOLUTION, N.O.S.(Contains: Ammonium bisulfite)	8	-	
ADG	UN2683	BISULFITES, AQUEOUS SOLUTION, N.O.S.	8	-	

Section 14. Transport information

IMDG	UN2693	BISULFITES, AQUEOUS SOLUTION, N.O.S.	8	III	
IATA	UN2693	BISULFITES, AQUEOUS SOLUTION, N.O.S.	8	III	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** 2W
ADG Class	No.	**Hazchem code** 2W
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Section 15. Regulatory information

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 2

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
ACUTE TOXICITY (oral) - Category 4 SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1	Calculation method Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

NOXYGEN™ XT

Version 3.01

Section 1. Identification

Product identifier : NOXYGEN™ XT

Product code : 2626DF

ADG : -

Product type : Solid.

Identified uses : Oxygen scavenger

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
2,3-didehydro-3-O-sodio-D-erythro-hexono-1,4-lactone	60 - 100	6381-77-7

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Section 4. First aid measures

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Crystalline solid.]

Colour : White.

Odour : Odourless.

Odour threshold : Not available.

pH : 5.5 to 8.5

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 1.7

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
2,3-didehydro-3-O-sodio-D-erythro-hexono-1,4-lactone	LD50 Oral	Rat	>5 g/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Section 11. Toxicological information

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

Section 14. Transport information

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code -
ADG Class	No.	Hazchem code -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 9 April 2024.

Date of issue/Date of revision : 9 April 2024

Date of previous issue : 23 February 2024

Version : 3.01

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

NUT PLUG

Version 1

Section 1. Identification

Product identifier : NUT PLUG

Product code : 7808DF

ADG : -

Product type : Powder.

Identified uses : Lost Circulation Material

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
Walnut, Juglans regia, ext.	60 - 100	84012-43-1

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Section 4. First aid measures

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : No specific data.

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 6. Accidental release measures

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid breathing dust. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Section 8. Exposure controls and personal protection

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : Yellowish-brown.

Odour : Odourless.

Odour threshold : Not available.

pH : 7.5 [Conc. (% w/w): 2% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Closed cup: 193.3°C (379.9°F)

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 1.2 to 1.4

Solubility(ies) :

Media	Result
cold water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Section 9. Physical and chemical properties and safety characteristics

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Section 11. Toxicological information

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

Section 15. Regulatory information

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 19 May 2024.

Date of issue/Date of revision : 19 May 2024

Date of previous issue : No previous validation

Version : 1

Key to abbreviations : ADG = Australian Dangerous Goods
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IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

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Section 16. Any other relevant information

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Material Safety Data Sheet (MSDS)

Product: **Calcium Carbonate** (Limestone, Ground)

This document is prepared in accordance with the Australian National Code of Practice: NOHSC: 2011(2003).
This Document is in Conformity with regulation (EC) 1907 / 2006 Annex II.

NOT HAZARDOUS ACCORDING TO CRITERIA OF WORKSAFE AUSTRALIA

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name	Calcium Carbonate (Limestone Ground) other terms for Limestone are Calcite or Marble	
Trade Names:	Omyacarb®	Product Uses:
	1, 2, 5, 8, 10, 15, 20, 40,50	Paints, Coatings, adhesives, grouts
	Marble Chips (0,00,000), White Pool Dust	Textured coatings. Terazzo
	Circal®	
	60/16, Y Grade, 600, 1000, T Grade	Jointing cement filler, drilling muds, textured coatings, PVC tiles
	Limestone	
	Microfine, Y Grade, T Grade, DD, DD12, DD135, PF, Abgrit, Selgrit, F70, Superfine, Agricultural Grade, Omyacal 50®, Omyacal® 70, Omyacal® 12, Road Base, 6mm, Moonglow® Topping (10mm), Limestone 60/16	Glass, agricultural applications, animal feed, PVC tiles, and other applications
	Stonedust	Coalmine stone-dusting
	Betocarb®	
	1, 10, 12	Concrete improver
Other Names:	Natural Calcium Carbonate, Calcite, Limestone, Whiting, Marble, Chips	
Supplier Name:	Omya Australia Pty Ltd (ACN 001 682 533)	
Address:	Suite 202, 280 Pacific Highway, LINDFIELD NSW 2070.	
Telephone Number:	+61 2 9416 6077	
Facsimile Number:	+61 2 9416 8008	
Emergency Number:	**0419 498 007 (from within Australia)**	
	+61 419 498 007 (from outside of Australia)	
	Emergency contact service provided by Omya - Australia	
	(Operates Monday to Friday, 8:00am to 5:00pm Australian EST)	

2. HAZARDS IDENTIFICATION

Hazard Classification	**Non Hazardous Substance** according to the Criteria of NOHSC.
	Non Dangerous Good according to the Australian Dangerous Goods Code.
Risk Phrase(s):	None
Safety Phrase(s):	None
General Notes	Limestone powder particles may cause irritation to the skin and eyes. Prolonged and repeated exposure may cause irritation to the respiratory system. Dust exposure standards apply.

3. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENTS	Name	CAS	Proportion
	Limestone ($CaCo_3$)	1317-65-3	>99%

Natural, Limestone Ground - Calcium Carbonate. Also referred to as Calcite or Marble.

Naturally occurring sedimentary rock. Limestone (Ground): CAS-No. 1317-65-3

Ground with non-hazardous auxiliary agents

Silica, quartz (CAS No 14808-60-7) naturally-occurring impurity of Limestone in trace amounts. Magnesium Carbonate (CAS No 13717-00-5) is also naturally present.

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*Replaces: AU- MSDS-01 Issue 17

Product: **Calcium Carbonate** (Limestone Ground)

4. FIRST AID MEASURES

EYE CONTACT:



Rinse with plenty of clean water.

In case of continued irritation, seek medical advice.

SKIN CONTACT:



Wash with water

INHALATION: Move person to fresh air.

In case of indisposition, seek medical advice.

INGESTION: Symptomatic treatment.
In case of indisposition, seek medical advice.

5. FIRE FIGHTING MEASURES

FLAMABILITY: Non-flammable, non- combustible substance.

SPECIAL RISKS: Can release CO_2 or CO in extreme temperature conditions i.e. > 825 ℃.

EXTINGUISHING AGENTS: All common extinguishing media compatible.

HAZCHEM CODE: Not regulated.

6. ACCIDENTAL RELEASE MEASURES

PRECAUTIONS: Will not dissolve in water. Do not flush down drains or into water ways.
Slippery when wet – cordon off for road and pedestrian traffic. Avoid contact with acids.

CONTAINMENT AND CLEAN UP: In case of spillage, avoid generating dust, wear respiratory protection when visibly dusty or for prolonged exposure, and sweep or vacuum. Very fine products should be collected in bag/containers, label appropriately
May be lightly wetted down to minimise dust

Cover or lightly wet down to minimize dust generation if spills cannot be dealt with immediately.

7. HANDLING AND STORAGE

HANDLING: Avoid generating airborne dust during handling and storage.
Avoid prolonged contact with skin
Avoid heavy or prolonged dust inhalation (See TWA Section 8).
Engineering dust controls should be used ahead of, or in combination with the wearing of appropriate respiratory protection.

STORAGE: Store in original packaging, under dry conditions.
Do not store with acids.
Keep fine products stored in closed containers. Avoid the generation of airborne dust

8. EXPOSURE CONTROL / PERSONAL PROTECTION

HAND PROTECTION:



Wear gloves to prevent irritation and drying out skin.

EYE PROTECTION:



Wear goggles if visible dust in air or if irritation occurs.

Do not wear contact lenses when handling this product, as particles may get trapped underneath and cause irritation.

SKIN PROTECTION: Clothing fully covering skin, full length pants, long sleeved overalls, with close fittings at openings. Footwear to avoid dust penetration.

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RESPIRATORY PROTECTION	Maintain air concentrations below the occupational exposure standards, using engineering controls if necessary.



Where this is not possible, wear an approved P1 dust mask where concentration is less than 10 times permissible exposure limit.

ASCC* TWA for $CaCO_3$ Inhalable Dust in Australia is: 3 mg/m^3

ACGIH** TLV for $CaCO_3$ Respirable Dust in Australia is: 10 mg/m^3

ASCC TWA for Respirable Quartz in Australia is: 0.1 mg/m^3

*Australian Safety and Compensation Council

** American Conference of Governmental Industrial Hygienists

ENVIRONMENTAL EXPOSURE CONTROLS	All ventilation systems should be filtered before discharge to atmosphere.

9. PHYSICAL AND CHEMICAL PROPERTIES

GENERAL INFORMATION

Appearance:	powder	
Colour:	white	
Odour	odourless	
pH Value:	8.5 - 9.5 (100 g/l / 20 ℃)	DIN- ISO 787/9
Melting Point:	1340 ℃ (102 bar)	
Boiling Point:	not applicable	
Flash Point:	not applicable	
Evaporation Rate	not applicable	
Flammability	non-flammable	
Upper/Lower Flammability Or Explosive Limits:	not applicable	
Explosive Properties	not explosive	
Vapour Pressure	negligible	
Vapour Density	not applicable	
Relative Density:	2.7 (20 ℃)	DIN-ISO 787/10
Solubility		
A) Water Solubility:	0.014 g/l (20 ℃) 0.018 g/l (75 ℃)	DIN-ISO 787/8
B) Fat Solubility	Data not available	
Partition Coefficient N-Octanol/H_2O	< 1 (estimation)	
Auto-Ignition Temp	no self-ignition	
Decomposition Temp	> 825 ℃	
Viscosity	not applicable	

10. STABILITY AND REACTIVITY

REACTIVITY	Effervesces vigorously on contact with some acids.
CHEMICAL STABILITY	stable
POSSIBILITY OF HAZARDOUS REACTIONS	None known
CONDITIONS TO AVOID	Heating above 825 °C
INCOMPATIBLE MATERIALS	Avoid contact with acids
HAZARDOUS DECOMPOSITION PRODUCTS	Can react with acids under the formation of carbon dioxide (CO_2) that can displace oxygen (danger of suffocation).
FURTHER INFORMATION	none

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*Replaces: AU- MSDS-01 Issue 17

Product: **Calcium Carbonate** (Limestone Ground)

11. TOXICOLOGICAL INFORMATION

Acute Oral Toxicity	LD_{50} oral, rat = > 5000 mg/kg
Skin Corrosion/Irritation	Data not available
Serious Eye Damage/Irritation	Data not available
Respiratory or skin irritation	Inhalation of dust may cause discomfort in the upper respiratory tract. Prolonged and repeated inhalation of excessive dust may permanently affect the respiratory system. Prolonged and repeated exposure may cause skin dehydration and irritation skin conditions.
Germ cell mutagenicity	Data not available
Carcinogenicity	Data not available
Reproductive toxicity	Data not available
STOT – single exposure	Data not available
STOT – repeated exposure	Data not available
Aspiration hazard	Data not available

12. ECOLOGICAL INFORMATION

In its solid state, calcium carbonate is a natural mineral of the earth. In its dissolved state, the substance is a natural and indispensable component of natural waters.

Toxicity	
LC_{50} Fish 96 h	> 10'000 mg/l
LC_{50} Daphnia 49 h	> 1000 mg/l
LC_{50} Algae 72 h	> 200 mg/l
Persistence & degradability	Not readily degradable, except in acid conditions where it tends to have a neutralizing effect
Bioaccumulative potential	Calcium carbonate is a naturally occurring inorganic compound which has constituent elements that make up natural components of biological organisms
Mobility in soil	Calcium carbonate is practically insoluble except in acid conditions, and so presents a low soil mobility in most ground. Moreover it is commonly used as an effective soil conditioner and fertiliser.

13. DISPOSAL CONSIDERATIONS

Dispose of in appropriately licensed general landfill site in accordance with local, state and federal regulations. Waste should be bagged and labelled Special arrangements made to bury bulk waste upon dumping, limiting dust generation.

14. TRANSPORT INFORMATION

UN Number	None allocated
Proper shipping name	None allocated
GGVSee/IMDG CODE	None allocated
GGVE/GGVS	None allocated
RID/ADR	None allocated
ICAO/IATA-DGR	None allocated
ADNR	None allocated

15. REGULATORY INFORMATION

Poisons Schedule	Not a scheduled poison (Standard for the Uniform Scheduling of Drugs and Poisons No 22)
R-phrases	none
S-phrases	none

16. OTHER INFORMATION

Europe/EU	EINECS listed under No. 215-279-6
USA	TSCA Inventory listed under CAS No 1317-65-3
Canada	Limestone is exempt from the PDSL (naturally occurring substance)
Australia:	NICNAS AICS under CAS-No. 1317-65-3
Japan:	MITI registered under 1-122-122
People's Rep. of China:	CAS - 1317-65-3
South Korea:	CAS - 1317-65-3
New Zealand:	Exempt under HSNO

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*Replaces: AU- MSDS-01 Issue 17

Section 1. Identification

Product identifier : POTASSIUM CHLORIDE (KCL)

Product code : 100114

ADG : -

Product type : Powder.

Identified uses : Clay control

Supplier's details : Baker Hughes, Australia
108 Poole Street,
Welshpool,
Western Australia 6106,
Australia

Tel: +618 9350 3800
Fax: +618 9350 5453

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A

GHS label elements

Hazard pictograms :



GHS07

Signal word : WARNING

Hazard statements : H319 - Causes serious eye irritation.

Precautionary statements

Section 2. Hazard(s) identification

Prevention : Wear eye or face protection.

Response : IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice or attention.

Storage : Not applicable.

Disposal : Not applicable.

Precautionary statements (Code) : -, P280, P305 + P351 + P338, P337 + P313, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
potassium chloride	60 - 100	7447-40-7

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Section 4. First aid measures

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain or irritation,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : halogenated compounds,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Section 6. Accidental release measures

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Avoid dust generation. Using a vacuum with HEPA filter will reduce dust dispersal. Place spilled material in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing dust. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Section 8. Exposure controls and personal protection

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): neoprene rubber Gloves

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Granular. / Powder.]

Colour : Reddish-white.

Odour : Odourless.

Odour threshold : Not available.

pH : 9.2

Melting point/freezing point : 768 to 776°C

Boiling point, initial boiling point, and boiling range : 1413 to 1500°C (2575.4 to 2732°F)

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Section 9. Physical and chemical properties and safety characteristics

Relative vapour density : Not applicable.

Relative density : 1.98 to 1.99

Solubility(ies) :

Media	Result
cold water hot water	Easily soluble Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Reactive or incompatible with the following materials: oxidising materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
potassium chloride	LD50 Oral	Rat	2600 mg/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : May cause eye irritation.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Section 11. Toxicological information

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Routes of entry anticipated: Dermal, Inhalation.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain or irritation,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	-
ADG Class	No.	-
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 26 February 2024.

Date of issue/Date of revision : 26 February 2024

Date of previous issue : 29 January 2024

Version : 2

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A	Calculation method

Section 16. Any other relevant information

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : Potassium Hydroxide

Product code : 1416DF

ADG : Potassium hydroxide, solid or flake

Product type : Solid.

Identified uses : Alkalinity Control

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : ACUTE TOXICITY (oral) - Category 4
SKIN CORROSION/IRRITATION - Category 1A
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A
LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 3

GHS label elements

Hazard pictograms :



GHS05 GHS07

Signal word : DANGER

Section 2. Hazard(s) identification

Hazard statements : H302 - Harmful if swallowed.
H314 - Causes severe skin burns and eye damage.
H412 - Harmful to aquatic life with long lasting effects.

Precautionary statements

Prevention : Wear protective gloves: > 8 hours (breakthrough time): nitrile, neoprene or natural rubber (latex). Wear protective clothing. Wear eye or face protection. Avoid release to the environment. Do not eat, drink or smoke when using this product. Wash thoroughly after handling.

Response : IF INHALED: Immediately call a POISON CENTER or doctor. IF SWALLOWED: Immediately call a POISON CENTER or doctor. Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. Immediately call a POISON CENTER or doctor. Wash contaminated clothing before reuse. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice or attention.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P280, P273, P270, P264, P304 + P310, P301 + P310, P330, P331, P303 + P361 + P353, P310, P363, P305 + P351 + P338, P337 + P313, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
potassium hydroxide	60 - 100	1310-58-3

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Chemical burns must be treated promptly by a physician.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Section 4. First aid measures

Skin contact : Get medical attention immediately. Call a poison center or physician. Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Call a poison center or physician. Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Chemical burns must be treated promptly by a physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes severe burns.

Ingestion : Harmful if swallowed.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : This material is harmful to aquatic life with long lasting effects. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products : metal oxide/oxides

Section 5. Firefighting measures

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : 2W

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities.

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Avoid dust generation. Using a vacuum with HEPA filter will reduce dust dispersal. Place spilled material in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not get in eyes or on skin or clothing. Do not ingest. Avoid release to the environment. If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
potassium hydroxide	**Safe Work Australia (Australia, 10/2022).** PEAK: 2 mg/m³

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): nitrile, neoprene or natural rubber (latex)

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: particulate filter

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Granular solid.]

Colour : White.

Odour : Odourless.

Odour threshold : Not available.

pH : Not available.

Melting point/freezing point : 361°C

Boiling point, initial boiling point, and boiling range : 1324°C (2415.2°F)

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 2.044 (20°C)

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : May be harmful if ingested. Can cause target organ damage.

Irritation/Corrosion

Skin : Causes pain and burns in contact with skin. May cause permanent skin damage.

Eyes : May cause eye irritation.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes severe burns.

Ingestion : Harmful if swallowed.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Section 11. Toxicological information

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
potassium hydroxide	Acute LC50 80 ppm Fresh water	Fish - *Gambusia affinis* - Adult	96 hours

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	UN1813	Potassium hydroxide, solid or flake	8	II	
ADG	UN1813	Potassium hydroxide, solid or flake	8	II	

Section 14. Transport information

IMDG	UN1813	POTASSIUM HYDROXIDE, SOLID	8	II	
IATA	UN1813	POTASSIUM HYDROXIDE, SOLID	8	II	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** 2W
ADG Class	No.	**Hazchem code** 2W
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

6

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Section 15. Regulatory information

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 3

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
ACUTE TOXICITY (oral) - Category 4	Calculation method
SKIN CORROSION/IRRITATION - Category 1A	Calculation method
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A	Calculation method
LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 3	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : PYRO-TROL™ II

Product code : 9063DF

ADG : -

Product type : Powder.

Identified uses : High temperature Fluid Loss Control Additive

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : ACUTE TOXICITY (inhalation) - Category 4

GHS label elements

Hazard pictograms :



GHS07

Signal word : WARNING

Hazard statements : H332 - Harmful if inhaled.

Precautionary statements

Section 2. Hazard(s) identification

Prevention : Avoid breathing dust or mist.

Response : IF INHALED: Call a POISON CENTER or doctor if you feel unwell.

Storage : Not applicable.

Disposal : Not applicable.

Precautionary statements (Code) : -, P261, P304 + P312, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
Copolymer of acrylamide and 2-acrylamide-2-2methyl propane sulfonic acid	60 - 100	-

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Section 4. First aid measures

Inhalation : Harmful if inhaled. Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : No specific data.

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

Section 6. Accidental release measures

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Avoid dust generation. Using a vacuum with HEPA filter will reduce dust dispersal. Place spilled material in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing dust. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Section 9. Physical and chemical properties and safety characteristics

Colour : White to Light Yellow

Odour : Not available.

Odour threshold : Not available.

pH : 7 to 8

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 1.41 (1.36 – 1.46)

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Not available.

Section 10. Stability and reactivity

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Copolymer of acrylamide and 2-acrylamide-2-2methyl propane sulfonic acid	LC50 Inhalation Dusts and mists	Rat	2.22 mg/l	4 hours

Conclusion/Summary : Harmful if inhaled. Adverse health effects could include the following: breathing difficulty or shortness of breath

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Harmful if inhaled. Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Section 11. Toxicological information

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Section 14. Transport information

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code -
ADG Class	No.	Hazchem code -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : Not determined.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 2 May 2024.

Date of issue/Date of revision : 2 May 2024

Date of previous issue : No previous validation

Version : 1

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
ACUTE TOXICITY (inhalation) - Category 4	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : PYRO-VIS™ II

Product code : 9064DF

ADG : -

Product type : Solid.

Identified uses : High temperature Viscosifier

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1

GHS label elements

Hazard pictograms :



GHS05

Signal word : DANGER

Hazard statements : H318 - Causes serious eye damage.

Precautionary statements

Section 2. Hazard(s) identification

Prevention : Wear eye or face protection.

Response : IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor.

Storage : Not applicable.

Disposal : Not applicable.

Precautionary statements (Code) : -, P280, P305 + P351 + P338, P310, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	CAS number
2-methylpropan-2-ol	≤5	75-65-0

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Chemical burns must be treated promptly by a physician.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Get medical attention immediately. Call a poison center or physician. Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Section 4. First aid measures

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

Section 6. Accidental release measures

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Avoid dust generation. Using a vacuum with HEPA filter will reduce dust dispersal. Place spilled material in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not get in eyes or on skin or clothing. Do not ingest. If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
2-methylpropan-2-ol	**Safe Work Australia (Australia, 10/2022).** STEL: 455 mg/m³ 15 minutes. STEL: 150 ppm 15 minutes. TWA: 303 mg/m³ 8 hours. TWA: 100 ppm 8 hours.

Biological exposure indices

No exposure indices known.

Section 8. Exposure controls and personal protection

Appropriate engineering controls : If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Granular.]

Colour : White.

Odour : Not available.

Odour threshold : Not available.

pH : 5 to 8 [Conc. (% w/w): 0.5%]

Melting point/freezing point : >150°C

Section 9. Physical and chemical properties and safety characteristics

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 1.45 (1.40 – 1.50)

Not Available.

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Extremely reactive or incompatible with the following materials: oxidising materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
PYRO-VIS™ II	LD50 Dermal	Rat	>5000 mg/kg	-
	LD50 Oral	Rat	>5000 mg/kg	-
2-methylpropan-2-ol	LC50 Inhalation Gas.	Rat	14100 ppm	4 hours
	LD50 Oral	Rat	2733 mg/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Section 11. Toxicological information

Eyes : Risk of serious damage to eyes. May cause eye burns and permanent eye injury.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Product/ingredient name	Category	Route of exposure	Target organs
2-methylpropan-2-ol	Category 3	-	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : No specific data.

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Section 11. Toxicological information

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
PYRO-VIS™ II	Acute LC50 >100 mg/l	Algae	72 hours
	Acute LC50 >100 mg/l	Fish	96 hours
2-methylpropan-2-ol	Acute EC50 5504000 µg/l Fresh water	Daphnia - *Daphnia magna*	48 hours
	Acute LC50 6410000 µg/l Fresh water	Fish - *Pimephales promelas*	96 hours

Persistence and degradability

Not available.

Product/ingredient name	$LogP_{ow}$	BCF	Potential
2-methylpropan-2-ol	0.317	5.01	Low

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Section 14. Transport information

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	-
ADG Class	No.	-
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 2 May 2024.

Date of issue/Date of revision : 2 May 2024

Date of previous issue : No previous validation

Version : 1

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

Salt

Version 4

Section 1. Identification

Product identifier : Salt

Product code : 1874DF

ADG : -

Other means of identification : COMMON SALT, SODIUM CHLORIDE, NaCl, ROCK SALT, SALINE, SEA SALT, TABLE SALT, HALITE

Product type : Powder.

Identified uses : Salt.

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Section 2. Hazard(s) identification

Storage : Not applicable.

Disposal : Not applicable.

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Other means of identification : COMMON SALT, SODIUM CHLORIDE, NaCl, ROCK SALT, SALINE, SEA SALT, TABLE SALT, HALITE

Ingredient name	% (w/w)	CAS number
sodium chloride	60 - 100	7647-14-5

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Section 4. First aid measures

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : halogenated compounds,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Section 6. Accidental release measures

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid breathing dust. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Section 8. Exposure controls and personal protection

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): nitrile or neoprene

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : White.

Odour : Odourless.

Odour threshold : Not available.

pH : 6.7 to 7.3 [Conc. (% w/w): 1% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Section 9. Physical and chemical properties and safety characteristics

Relative density : Not available.

Solubility(ies) :

Media	Result
cold water	Partially soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
sodium chloride	LD50 Oral	Rat	3000 mg/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Section 11. Toxicological information

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
sodium chloride	Acute EC50 2430000 µg/l Fresh water	Algae - *Navicula seminulum*	96 hours
	Acute EC50 519.6 mg/l Fresh water	Crustaceans - *Cypris subglobosa*	48 hours
	Acute EC50 402600 µg/l Fresh water	Daphnia - *Daphnia magna*	48 hours
	Acute IC50 6.87 g/L Fresh water	Aquatic plants - *Lemna minor*	96 hours
	Acute LC50 1294600 µg/l Fresh water	Fish - *Lepomis macrochirus*	96 hours
	Acute LC50 1000000 µg/l Fresh water	Fish - *Morone saxatilis* - Larvae	96 hours
	Chronic NOEC 6 g/L Fresh water	Aquatic plants - *Lemna minor*	96 hours
	Chronic NOEC 0.314 g/L Fresh water	Daphnia - *Daphnia pulex*	21 days
	Chronic NOEC 100 mg/l Fresh water	Fish - *Gambusia holbrooki* - Adult	8 weeks
	Chronic NOEC 643000 µg/l Fresh water	Fish - *Oncorhynchus mykiss* - Egg	56 days

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Section 14. Transport information

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 4

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : SAPP

Product code : 1364DF

ADG : -

Product type : Powder.

Identified uses : Dispersant

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A

GHS label elements

Hazard pictograms :



GHS07

Signal word : WARNING

Hazard statements : H319 - Causes serious eye irritation.

Precautionary statements

Section 2. Hazard(s) identification

Prevention : Wear eye or face protection.

Response : IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice or attention.

Storage : Not applicable.

Disposal : Not applicable.

Precautionary statements (Code) : -, P280, P305 + P351 + P338, P337 + P313, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
disodium dihydrogenpyrophosphate	60 - 100	7758-16-9

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Section 4. First aid measures

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain or irritation,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : phosphorus oxides,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Section 6. Accidental release measures

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Avoid dust generation. Using a vacuum with HEPA filter will reduce dust dispersal. Place spilled material in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing dust. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

Section 8. Exposure controls and personal protection

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): Nitrile gloves. Neoprene gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : White.

Odour : Faint odour.

Odour threshold : Not available.

Section 9. Physical and chemical properties and safety characteristics

pH : 4.5 [Conc. (% w/w): 1% - (H2O)]

Melting point/freezing point : >900°C

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 1.8

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : May cause eye irritation.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain or irritation,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Section 11. Toxicological information

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code -
ADG Class	No.	Hazchem code -
IMDG Class	No.	-
IATA Class	No.	-

Section 14. Transport information

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 6

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container

Section 16. Any other relevant information

IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A	Expert judgment

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

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RADIAGREEN EME SALT

Safety Data Sheet

according to the REACH Regulation (EC) 1907/2006 amended by Regulation (EU) 2020/878
OLEON is a registered trademark. - RADIAGREEN is a registered trademark of Oleon NV.
Issue date: 21/06/2024 Revision date: 20/06/2024 Supersedes version of: 03/10/2023 Version: 2.22

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Mixture
Generic name : RADIAGREEN EME SALT
REACH number : all the ingredients of this product in the scope of Regulation 1907/2006/EC (REACH), if not exempted, have been registered.
C&L notification reference no : all the ingredients of this product in the scope of Regulation 1272/2008/EC (CLP), if not exempted, have been notified to the C&L Inventory.

1.2. Relevant identified uses of the substance or mixture and uses advised against

1.2.1. Relevant identified uses

Main use category : Industrial use

1.2.2. Uses advised against

No additional information available

1.3. Details of the supplier of the safety data sheet

OLEON N.V.
Assenedestraat 2
BE 9940 Ertvelde
Belgium
T +32 9 341 10 11, F +32 9 341 10 00
sds@oleon.com, www.oleon.com

1.4. Emergency telephone number

Emergency number : 24/7 EMERGENCY NUMBER (SGS ERS; Oleon contract nr 76858)
+32 3 575 55 55 (worldwide); +1 888 765 6554 (USA tollfree)

Country	Organisation/Company	Address	Emergency number	Comment
	World directory of poisons centres (Yellow Tox) WHO-OMS	Website	http://www.who.int/gho/phe/chemical_safety/poisons_centres/en/	

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Not classified

Adverse physicochemical, human health and environmental effects

Not classified as dangerous according to the criteria of Australian NOHSC (not hazardous; not dangerous goods). According to ABNT NBR 14725: 2023, no labeling obligation.

2.2. Label elements

Labelling according to Regulation (EC) No. 1272/2008 [CLP]

No labelling applicable

2.3. Other hazards

Other hazards which do not result in classification : None under normal conditions.

Contains no PBT and/or vPvB substances ≥ 0.1% assessed in accordance with REACH Annex XIII

The mixture does not contain substance(s) included in the list established in accordance with Article 59(1) of REACH for having endocrine disrupting properties, or substance(s) are not identified as having endocrine disrupting properties in accordance with the criteria set out in Commission Delegated Regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at a concentration equal to or greater than 0,1 %

Component	
Fatty esters	The substance is not included in the list established in accordance with Article 59(1) of REACH for having endocrine disrupting properties, or is not identified as having endocrine disrupting properties in accordance with the criteria set out in Commission Delegated Regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605

SECTION 3: Composition/information on ingredients

3.1. Substances

Not applicable

3.2. Mixtures

Name	Product identifier	%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
Fatty esters (Constituent)	-	> 60	Not classified
specialty chemicals (Constituent)	-	< 40	Not classified

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : If you feel unwell, seek medical advice.

First-aid measures after inhalation : Remove victim to fresh air. Respiratory problems: consult a doctor/medical service.

First-aid measures after skin contact : Wash off immediately with soap and plenty of water. If irritation persists, consult a doctor.

First-aid measures after eye contact : Rinse immediately with plenty of water. Consult an ophtalmologist if irritation persists.

First-aid measures after ingestion : Rinse mouth out with water. Get medical advice/attention if you feel unwell.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/effects : Unlikely.

4.3. Indication of any immediate medical attention and special treatment needed

No supplementary information available.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : AFFF foam. BC-powder. Carbon dioxide. Dry sand. Dry chemical powder. Use the extinguishing media recommended for the burning materials and fire situation.

Unsuitable extinguishing media : Solid water jet ineffective as extinguishing medium.

5.2. Special hazards arising from the substance or mixture

Fire hazard : DIRECT FIRE HAZARD: Combustible. INDIRECT FIRE HAZARD: Heating increases the fire hazard. Temperature above flashpoint: higher fire/explosion hazard.

Explosion hazard : No direct explosion hazard.

Reactivity in case of fire : On burning: release of carbon monoxide/carbon dioxide.

5.3. Advice for firefighters

Other information : No supplementary information available.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Mark the danger area. Exposure to fire/heat: have neighbourhood close doors and windows. Exposure to fire/heat: consider evacuation. Wash contaminated clothing before reuse.

6.1.1. For non-emergency personnel

Protective equipment : See "Material-Handling" to select protective clothing.

6.1.2. For emergency responders

Protective equipment : Use protective measures listed in Section 8.

6.2. Environmental precautions

Prevent soil and water pollution.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up : Clean contaminated surfaces with a soap solution. Flush/dilute with water. Take up liquid spill into inert absorbent material, e.g.: sand, earth, vermiculite, powdered limestone.

Other information : No supplementary information available.

6.4. Reference to other sections

Handle waste materials in accordance with the provisions of Section 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Smoking, eating and drinking should be prohibited in areas of storage and use.

Handling temperature : ≥ 10 °C above melting point

Hygiene measures : Wash hands before work breaks and after finishing work. Good standard of personal hygiene.

7.2. Conditions for safe storage, including any incompatibilities

Information on mixed storage : No supplementary information available.
Storage area : Keep container in a well-ventilated place. Store at ambient temperature. Keep out of direct sunlight. Meet the legal requirements.
Special rules on packaging : Store in a closed container. Suitably labelled. Meet the legal requirements.
Packaging materials : No supplementary information available.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

8.1.1 National occupational exposure and biological limit values

No additional information available

8.1.2. Recommended monitoring procedures

No additional information available

8.1.3. Air contaminants formed

No additional information available

8.1.4. DNEL and PNEC

No additional information available

8.1.5. Control banding

No additional information available

8.2. Exposure controls

8.2.1. Appropriate engineering controls

No additional information available

8.2.2. Personal protection equipment

Personal protective equipment:
Gloves. Protective clothing. Safety glasses.

Personal protective equipment symbol(s):



8.2.2.1. Eye and face protection

No additional information available

8.2.2.2. Skin protection

Other skin protection

Materials for protective clothing:
Good resistance: Nitrile rubber

8.2.2.3. Respiratory protection

No additional information available

8.2.2.4. Thermal hazards

No additional information available

8.2.3. Environmental exposure controls

Other information:

NOHSC Exposure Standards: no exposure standard applicable according to HSIS.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	:	Liquid
Colour	:	Yellow-amber.
Appearance (room temperature)	:	Liquid.
Odour	:	Sweet. characteristic.
Odour threshold	:	Not available
Melting point	:	< -10 °C
Freezing point	:	Not available
Boiling point	:	> 250 °C
HMIS Flammability	:	Not available
Explosive properties	:	Product is not explosive.
Explosive limits	:	Not available
Lower explosion limit	:	Not available
Upper explosion limit	:	Not available
Flash point	:	> 200 °C (ASTM D92)
Auto-ignition temperature	:	> 300 °C
Decomposition temperature	:	> Flash point
pH	:	5 – 8
Viscosity, kinematic	:	ca. 120 mm^2/s (40°C)
Viscosity, dynamic	:	
Solubility	:	Insoluble in water.
Partition coefficient n-octanol/water (Log Kow)	:	Not available
Partition coefficient n-octanol/water (Log Pow)	:	> 5
Vapour pressure	:	No supplementary information available
Vapour pressure at 50 °C	:	Not available
Density	:	ca. 1002.4 kg/m^3 (20°C) ca. 987.5 kg/m^3 (40°C) ca. 942.6 kg/m^3 (100°C)
Relative density	:	Not available
Relative vapour density at 20°C	:	Not available
Particle characteristics	:	Not applicable

Fatty esters	
Vapour pressure	No supplementary information available

9.2. Other information

9.2.1. Information with regard to physical hazard classes

No additional information available

9.2.2. Other safety characteristics

VOC content : < 1 % (1999/13/EC; 2004/42/EC; 2010/75/EU; SR 814.018)

Other properties : Oily,Soluble in oils/fats,Soluble in most organic solvents,Insoluble in water

SECTION 10: Stability and reactivity

10.1. Reactivity

On burning: release of carbon monoxide/carbon dioxide.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

No additional information available

10.4. Conditions to avoid

No supplementary information available.

10.5. Incompatible materials

No supplementary information available.

10.6. Hazardous decomposition products

No supplementary information available.

SECTION 11: Toxicological information

11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008

Acute toxicity (oral) : Not classified

Acute toxicity (dermal) : Not classified

Acute toxicity (inhalation) : Not classified

RADIAGREEN EME SALT	
LD50 oral rat	> 5000 mg/kg Non-toxic

Fatty esters	
LD50 oral rat	> 5000 mg/kg Non-toxic

specialty chemicals	
LD50 oral rat	> 2000 mg/kg
LD50 dermal rabbit	> 2000 mg/kg

Skin corrosion/irritation : Not classified
pH: 5 – 8

Serious eye damage/irritation : Not classified (Conclusive but not sufficient for classification).
pH: 5 – 8

Respiratory or skin sensitisation : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Reproductive toxicity	:	Not classified
STOT-single exposure	:	Not classified
STOT-repeated exposure	:	Not classified
Aspiration hazard	:	Not classified

RADIAGREEN EME SALT	
Viscosity, kinematic	ca. 120 mm^2/s (40°C)

Fatty esters	
Viscosity, kinematic	ca. 80 mm^2/s @40°C (75-90)

specialty chemicals	
Viscosity, kinematic	ca. 912.7 mm^2/s

11.2. Information on other hazards

11.2.1. Endocrine disrupting properties

Adverse health effects caused by endocrine disrupting properties : The substance/mixture has no endocrine disrupting properties.

11.2.2. Other information

No additional information available

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general	:	The product is not considered harmful to aquatic organisms nor to cause long-term adverse effects in the environment. An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Ecology - air	:	No supplementary information available.
Ecology - water	:	No bioaccumulation data available
Hazardous to the aquatic environment, short–term (acute)	:	Not classified
Hazardous to the aquatic environment, long–term (chronic)	:	Not classified

12.2. Persistence and degradability

Fatty esters	
Biodegradation	88.1 % (OECD 301B- BfB report OL58506.01.01 - 02/2006)

12.3. Bioaccumulative potential

RADIAGREEN EME SALT	
Partition coefficient n-octanol/water (Log Pow)	> 5

Fatty esters	
Partition coefficient n-octanol/water (Log Pow)	> 5

12.4. Mobility in soil

No additional information available

12.5. Results of PBT and vPvB assessment

No additional information available

12.6. Endocrine disrupting properties

Adverse effects on the environment caused by endocrine disrupting properties : The substance is not included in the list established in accordance with Article 59(1) of REACH for having endocrine disrupting properties, or is not identified as having endocrine disrupting properties in accordance with the criteria set out in Commission Delegated Regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605

12.7. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Disposal : Prevent dispersion by covering with dry absorbent,Scoop solid spill into closing containers,Scoop absorbed substance into closing containers,Clean contaminated surfaces with an excess of water and soap solution,Wash clothing and equipment after handling

Regional waste regulation : No supplementary information available.

Ecological information : Do not discharge into drains or the environment. Remove to an authorized waste treatment plant.

European List of Waste (LoW, EC 2000/532) : No supplementary information available

HP Code : HP4 - "Irritant – skin irritation and eye damage:" waste which on application can cause skin irritation or damage to the eye.

SECTION 14: Transport information

In accordance with ADR / IMDG / IATA / ADN / RID

14.1. UN number or ID number

UN-No. (ADR) : UN No dangerous good in sense of transport regulations (including Australian DG Code)

UN-No. (IMDG) : Not applicable

UN-No. (IATA) : Not applicable

UN-No. (ADN) : Not applicable

UN-No. (RID) : Not applicable

14.2. UN proper shipping name

Proper Shipping Name (ADR) : Not applicable

Proper Shipping Name (IMDG) : Not applicable

Proper Shipping Name (IATA) : Not applicable

Proper Shipping Name (ADN) : Not applicable

Proper Shipping Name (RID) : Not applicable

Transport document description (ADR) : UN No dangerous good in sense of transport regulations (including Australian DG Code)

14.3. Transport hazard class(es)

ADR

Transport hazard class(es) (ADR) : Not applicable

IMDG

Transport hazard class(es) (IMDG) : -

IATA

Transport hazard class(es) (IATA) : Not applicable

ADN

Transport hazard class(es) (ADN) : Not applicable

RID

Transport hazard class(es) (RID) : Not applicable

14.4. Packing group

Packing group (ADR) : Not applicable
Packing group (IMDG) : Not applicable
Packing group (IATA) : Not applicable
Packing group (ADN) : Not applicable
Packing group (RID) : Not applicable

14.5. Environmental hazards

Dangerous for the environment : No
Marine pollutant : No
Other information : Marine pollutant: no

14.6. Special precautions for user

Overland transport

Transport regulations (ADR) : Not subject

Transport by sea

Transport regulations (IMDG) : Not subject

Air transport

Transport regulations (IATA) : Not subject

Inland waterway transport

No data available

Rail transport

Transport regulations (RID) : Not subject

14.7. Maritime transport in bulk according to IMO instruments

Not applicable

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

15.1.1. EU-Regulations

REACH Annex XVII (Restriction List)

Contains no substance(s) listed on REACH Annex XVII (Restriction Conditions)

REACH Annex XIV (Authorisation List)

Contains no substance(s) listed on REACH Annex XIV (Authorisation List)

REACH Candidate List (SVHC)

Contains no substance(s) listed on the REACH Candidate List

PIC Regulation (Prior Informed Consent)

Contains no substance(s) listed on the PIC list (Regulation EU 649/2012 concerning the export and import of hazardous chemicals)

POP Regulation (Persistent Organic Pollutants)

Contains no substance(s) listed on the POP list (Regulation EU 2019/1021 on persistent organic pollutants)

Ozone Regulation (1005/2009)

Contains no substance(s) listed on the Ozone Depletion list (Regulation EU 1005/2009 on substances that deplete the ozone layer)

VOC Directive (2004/42)

VOC content : < 1 % (1999/13/EC; 2004/42/EC; 2010/75/EU; SR 814.018)

Explosives Precursors Regulation (2019/1148)

Contains no substance(s) listed on the Explosives Precursors list (Regulation EU 2019/1148 on the marketing and use of explosives precursors)

Drug Precursors Regulation (273/2004)

Contains no substance(s) listed on the Drug Precursors list (Regulation EC 273/2004 on the manufacture and the placing on market of certain substances used in the illicit manufacture of narcotic drugs and psychotropic substances)

15.1.2. National regulations

Chemical inventories : Compliant with AIIC, DSL, EAEU, ECST, EU REACh, IECSC, KECL, NZIoC, TSCA

KKDIK number (Turkey) : all the ingredients of this product in the scope of KKDIK, if not exempted, have been (pre-)registered.

K-REACh (Korea) : not all the ingredients of this product in the scope of K-REACh have been (pre-)registered.

UK-REACh (Great Britain) : not all the ingredients of this product in the scope of UK-REACh have been notified.

Germany

Water hazard class (WGK) : Not classified according to Regulation Governing Systems for Handling Substances Hazardous to Waters (AwSV).

Hazardous Incident Ordinance (12. BImSchV) : Is not subject to the Hazardous Incident Ordinance (12. BImSchV)

Netherlands

ABM category : A(4) - low hazard for aquatic organisms, may have longterm hazardous effects in aquatic environment

SZW-lijst van kankerverwekkende stoffen : None of the components are listed

SZW-lijst van mutagene stoffen : None of the components are listed

SZW-lijst van reprotoxische stoffen – Borstvoeding : None of the components are listed

SZW-lijst van reprotoxische stoffen – Vruchtbaarheid : None of the components are listed

SZW-lijst van reprotoxische stoffen – Ontwikkeling : None of the components are listed

Denmark

Danish product registration number : 2319737

15.2. Chemical safety assessment

No additional information available

SECTION 16: Other information

Training advice : No supplementary information available.

Chem. inventories legend : AIIC = Australian Inventory of Industrial Chemicals
DSL = Canadian Domestic Sustances List
EAEU = Eurasian Economic Union Unified list of chemicals
ECST = Existing Chemical Substances Inventory of Taiwan
EU REACh = European Union REACH Regulation 1907/2006
IECSC = Inventory of Existing Chemicals Substances in China
KECL = Korean Existing Chemical List
NZIoC = New Zealand Inventory of Chemicals
TSCA (Active) = USA Toxic Substances Control Act

SDS changed sections : 11 - Toxicological information;12 - Ecological information

SDS Reason for revision : No supplementary information available

Other information : No supplementary information available.

The classification complies with : ATP 8

SDS EU Oleon Annex II

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

SAFETY DATA SHEET

Soda Ash

Version 4

Section 1. Identification

Product identifier : Soda Ash

Product code : 5046DF

ADG : -

Other means of identification : Sodium carbonate

Product type : Solid.

Identified uses : pH control

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1
SPECIFIC TARGET ORGAN TOXICITY - SINGLE EXPOSURE (Respiratory tract irritation) - Category 3

GHS label elements

Hazard pictograms :



GHS05 GHS07

Section 2. Hazard(s) identification

Signal word : DANGER

Hazard statements : H318 - Causes serious eye damage.
H335 - May cause respiratory irritation.

Precautionary statements

Prevention : Wear eye or face protection. Avoid breathing dust.

Response : IF INHALED: Call a POISON CENTER or doctor if you feel unwell. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor.

Storage : Store in a well-ventilated place. Keep container tightly closed.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P280, P261, P304 + P312, P305 + P351 + P338, P310, P403 + P233, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Other means of identification : Sodium carbonate

Ingredient name	% (w/w)	CAS number
sodium carbonate	60 - 100	497-19-8

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Chemical burns must be treated promptly by a physician.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Get medical attention immediately. Call a poison center or physician. Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : May cause respiratory irritation.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Avoid dust generation. Using a vacuum with HEPA filter will reduce dust dispersal. Place spilled material in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not get in eyes or on skin or clothing. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

Section 8. Exposure controls and personal protection

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): Nitrile gloves. or Neoprene gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Granular solid.]

Colour : White.

Odour : Odourless.

Odour threshold : Not available.

pH : 11.4

Section 9. Physical and chemical properties and safety characteristics

Melting point/freezing point	:	851.11°C
Boiling point, initial boiling point, and boiling range	:	Not available.
Flash point	:	Not applicable.
Evaporation rate	:	Not available.
Flammability (solid, gas)	:	Non-flammable.
Lower and upper explosion limit/ flammability limit	:	Not applicable.
Vapour pressure	:	Not available.
Relative vapour density	:	Not applicable.
Relative density	:	2.509 Not Available.
Partition coefficient: n-octanol/water	:	Not applicable.
Auto-ignition temperature	:	Not applicable.
Decomposition temperature	:	Not available.
Viscosity	:	Not available.
Explosive properties	:	Not available.
Oxidising properties	:	Not available.

Other information

Pour point	:	Not available.

Section 10. Stability and reactivity

Reactivity	:	No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	:	The product is stable.
Possibility of hazardous reactions	:	Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	:	No specific data.
Incompatible materials	:	Reactive or incompatible with the following materials: acids. Aluminum powder, acids, fluorine, molten lithium.
Hazardous decomposition products	:	Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary	:	No known significant effects or critical hazards.

Irritation/Corrosion

Skin	:	No known significant effects or critical hazards.
Eyes	:	Risk of serious damage to eyes. May cause eye burns and permanent eye injury.

Section 11. Toxicological information

Respiratory : May cause respiratory irritation. Inhalation of the spray or mist may produce severe irritation of respiratory tract, characterised by coughing, choking or shortness of breath.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Product/ingredient name	Category	Route of exposure	Target organs
sodium carbonate	Category 3	-	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Routes of entry anticipated: Dermal, Inhalation.

Potential acute health effects

Eye contact : Causes serious eye damage.

Inhalation : May cause respiratory irritation.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : pain or irritation,redness,blistering may occur

Ingestion : Adverse symptoms may include the following:,stomach pains

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Section 11. Toxicological information

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
sodium carbonate	Acute EC50 242000 µg/l Fresh water	Algae - *Navicula seminulum*	96 hours
	Acute LC50 176000 µg/l Fresh water	Crustaceans - *Amphipoda*	48 hours
	Acute LC50 265000 µg/l Fresh water	Daphnia - *Daphnia magna*	48 hours
	Acute LC50 300000 µg/l Fresh water	Fish - *Lepomis macrochirus*	96 hours

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Section 14. Transport information

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code -
ADG Class	No.	Hazchem code -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

5

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 4

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 1 SPECIFIC TARGET ORGAN TOXICITY - SINGLE EXPOSURE (Respiratory tract irritation) - Category 3	Calculation method Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

Sodium Bicarbonate

Version 2

Section 1. Identification

Product identifier : Sodium Bicarbonate

Product code : 100080

ADG : -

Product type : Powder.

Identified uses : Buffer

Supplier's details : Baker Hughes, Australia
108 Poole Street,
Welshpool,
Western Australia 6106,
Australia

Tel: +618 9350 3800
Fax: +618 9350 5453

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
sodium hydrogencarbonate	60 - 100	144-55-8

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Section 4. First aid measures

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid breathing dust. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Do not store above the following temperature: 65°C (149°F). Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Section 8. Exposure controls and personal protection

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Crystalline powder.]

Colour : White.

Odour : None.

Odour threshold : Not available.

pH : 8.3 [Conc. (% w/w): 1% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : 851°C (1563.8°F)

Flash point : [Product does not sustain combustion.]

Evaporation rate : Not available.

Flammability (solid, gas) : Non-flammable.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 2.2

Solubility(ies) :

Media	Result
cold water	Very slightly soluble
hot water	Very slightly soluble

Section 9. Physical and chemical properties and safety characteristics

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
sodium hydrogencarbonate	LD50 Oral	Rat	4220 mg/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Section 11. Toxicological information

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
sodium hydrogencarbonate	Acute EC50 650000 µg/l Fresh water	Algae - *Navicula seminulum*	96 hours
	Acute LC50 767.87 mg/l Marine water	Crustaceans - *Americamysis bahia*	48 hours
	Acute LC50 7550 ppm Fresh water	Fish - *Gambusia affinis* - Adult	96 hours
	Chronic NOEC 576 mg/l Fresh water	Daphnia - *Daphnia magna* - Neonate	3 weeks

Persistence and degradability

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Section 14. Transport information

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 26 February 2024.

Date of issue/Date of revision : 26 February 2024

Date of previous issue : 10 March 2023

Version : 2

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships,

Section 16. Any other relevant information

1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

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Baker Hughes

SAFETY DATA SHEET

TEQ-DEFOAM 1538

Version 1

Section 1. Identification

Product identifier : TEQ-DEFOAM 1538

Product code : 9183DF

ADG : -

Product type : Liquid.

Identified uses : Defoamer

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : ASPIRATION HAZARD - Category 1

GHS label elements

Hazard pictograms :



GHS08

Signal word : DANGER

Hazard statements : H304 - May be fatal if swallowed and enters airways.

Precautionary statements

Section 2. Hazard(s) identification

Prevention : Not applicable.

Response : IF SWALLOWED: Immediately call a POISON CENTER or doctor. Do NOT induce vomiting.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, -, P301 + P310, P331, -, P501

Supplemental label elements : Repeated exposure may cause skin dryness or cracking.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

Ingredient name	% (w/w)	Identifiers
Hydrocarbons, C14-C17, n-alkanes, <2% aromatics	60 - 70	CAS: 64771-72-8
Hydrocarbons, C10-C14, n-alkanes, isoalkanes, <2% aromatics	20 - 30	CAS: 64771-72-8

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Wash skin thoroughly with soap and water or use recognised skin cleanser. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Aspiration hazard if swallowed. Can enter lungs and cause damage. Do not induce vomiting. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Section 4. First aid measures

Inhalation : No known significant effects or critical hazards.

Skin contact : Defatting to the skin. May cause skin dryness and irritation.

Ingestion : May be fatal if swallowed and enters airways.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : irritation,dryness,cracking

Ingestion : Adverse symptoms may include the following:,nausea or vomiting

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : No specific data.

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Avoid breathing vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Section 6. Accidental release measures

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not swallow. Avoid contact with eyes, skin and clothing. Avoid breathing vapour or mist. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Section 8. Exposure controls and personal protection

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid. [Clear.]

Colour : Colourless.

Odour : Hydrocarbon.

Odour threshold : Not available.

pH : Not available.

Melting point/freezing point : <-1°C

Boiling point or initial boiling point and boiling range : 228 to 258°C (442.4 to 496.4°F)

Flash point : Closed cup: 97°C (206.6°F) [ASTM D 93]

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Vapour pressure : Not available.

Relative vapour density : Not available.

Relative density : 0.8 to 0.9 (20°C)

Section 9. Physical and chemical properties and safety characteristics

Solubility(ies) :

Media	Result
water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Reactive or incompatible with the following materials: oxidising materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Respiratory or skin sensitization

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Germ cell mutagenicity

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Product/ingredient name	Result
Not available.	

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Hydrocarbons, C14-C17, n-alkanes, <2% aromatics	ASPIRATION HAZARD - Category 1
Hydrocarbons, C10-C14, n-alkanes, isoalkanes, <2% aromatics	ASPIRATION HAZARD - Category 1

Information on likely routes of exposure

Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : Defatting to the skin. May cause skin dryness and irritation.

Ingestion : May be fatal if swallowed and enters airways.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : irritation,dryness,cracking

Ingestion : Adverse symptoms may include the following:,nausea or vomiting

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Product/ingredient name	Result
Not available.	

General : Prolonged or repeated contact can defat the skin and lead to irritation, cracking and/or dermatitis.

Product/ingredient name	Result
Not available.	

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Product/ingredient name	Oral (mg/kg)	Dermal (mg/kg)	Inhalation (gases) (ppm)	Inhalation (vapours) (mg/l)	Inhalation (dusts and mists) (mg/l)
N/A					

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Not available.

Persistence and degradability

Product/ingredient name	Result
Not available.	

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Not available.			

Bioaccumulative potential

Not available.

Mobility in soil

Soil/water partition coefficient : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	

Section 14. Transport information

IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	Hazchem code -
ADG Class	No.	Hazchem code -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

National inventory

Section 15. Regulatory information

Australia inventory (AIIC) : All components are listed or exempted.

Section 16. Any other relevant information

History

Date of printing : 14 May 2026.

Date of issue/Date of revision : 14 May 2026

Date of previous issue : No previous validation

Version : 1

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
ASPIRATION HAZARD - Category 1	Expert judgment

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

TEQ-LUBE 673

Version 1

Section 1. Identification

Product identifier : TEQ-LUBE 673

Product code : 9181DF

ADG : -

Product type : Liquid.

Identified uses : Lubricant

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Prevention : Not applicable.

Response : Not applicable.

Section 2. Hazard(s) identification

Storage : Not applicable.

Disposal : Not applicable.

Precautionary statements (Code) : P103, P102, P101, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

There are no ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Section 4. First aid measures

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid.

Colour : Yellow to amber.

Odour : Sweet.

Odour threshold : Not available.

pH : Not available.

Melting point/freezing point : <-10°C

Boiling point or initial boiling point and boiling range : >250°C (>482°F)

Flash point : Closed cup: >200°C (>392°F) [ASTM D 92]

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Vapour pressure : Not available.

Relative vapour density : Not available.

Relative density : 0.97 to 0.995

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : >300°C (>572°F)

Decomposition temperature : Not available.

Viscosity : Kinematic (40°C): 120 cSt

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Respiratory or skin sensitization

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Germ cell mutagenicity

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure

Not available.

Product/ingredient name	Result
Not available.	

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Product/ingredient name	Result
Not available.	

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Product/ingredient name	Oral (mg/kg)	Dermal (mg/kg)	Inhalation (gases) (ppm)	Inhalation (vapours) (mg/l)	Inhalation (dusts and mists) (mg/l)
N/A					

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Not available.

Persistence and degradability

Product/ingredient name	Result
Not available.	

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Not available.			

Bioaccumulative potential

Section 12. Ecological information

Not available.

Mobility in soil

Soil/water partition coefficient : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

National inventory

Australia inventory (AIIC) : All components are listed or exempted.

Section 16. Any other relevant information

History

Date of printing : 7 December 2025.

Date of issue/Date of revision : 7 December 2025

Date of previous issue : No previous validation

Version : 1

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Section 16. Any other relevant information

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

TEQ-SWEEP 962

Version 1

Section 1. Identification

Product identifier : TEQ-SWEEP 962

Product code : 9205DF

ADG : -

Product type : Solid.

Identified uses : Lost Circulation Material

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	Identifiers
1-Propene, homopolymer	60 - 100	CAS: 9003-07-0

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Section 4. First aid measures

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Fibres.]

Colour : White.

Odour : Odourless.

Odour threshold : Not available.

pH : Not available.

Melting point/freezing point : 175°C

Boiling point or initial boiling point and boiling range : Not available.

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 1.2 to 1.3 (20°C)

Solubility(ies) :

Media	Result
water	Not soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Reactive or incompatible with the following materials: oxidising materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Respiratory or skin sensitization

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Germ cell mutagenicity

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Product/ingredient name	Result
Not available.	

Conclusion/Summary : No known significant effects or critical hazards.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure

Not available.

Product/ingredient name	Result
Not available.	

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Product/ingredient name	Result
Not available.	

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Product/ingredient name	Oral (mg/kg)	Dermal (mg/kg)	Inhalation (gases) (ppm)	Inhalation (vapours) (mg/l)	Inhalation (dusts and mists) (mg/l)
N/A					

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Not available.

Persistence and degradability

Product/ingredient name	Result
Not available.	

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Not available.			

Bioaccumulative potential

Section 12. Ecological information

Not available.

Mobility in soil

Soil/water partition coefficient : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

National inventory

Australia inventory (AIIC) : All components are listed or exempted.

Section 16. Any other relevant information

History

Date of printing : 29 July 2026.

Date of issue/Date of revision : 29 July 2026

Date of previous issue : No previous validation

Version : 1

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Section 16. Any other relevant information

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

Triethanolamine

Version 2

Section 1. Identification

Product identifier : Triethanolamine

Product code : 1738DF

Chemical identity : 2,2',2''-nitrilotriethanol

Other means of identification : TRIETHANOLAMINE; Ethanol, 2,2',2''-nitrilotris-; 2,2',2''-Trihydroxyethylamine; Tris (2-hydroxyethyl)amine; trolamine; Ethanol, 2,2',2''-nitrilotri-

Product type : Liquid.

Identified uses : Various.

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Section 2. Hazard(s) identification

Storage : Not applicable.

Disposal : Not applicable.

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Chemical identity : 2,2',2''-nitrilotriethanol

Other means of identification : TRIETHANOLAMINE; Ethanol, 2,2',2''-nitrilotris-; 2,2',2''-Trihydroxyethylamine; Tris (2-hydroxyethyl)amine; trolamine; Ethanol, 2,2',2''-nitrilotri-

Ingredient name	% (w/w)	CAS number
Triethanolamine	60 - 100	102-71-6

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Section 4. First aid measures

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Section 6. Accidental release measures

Large spill : Stop leak if without risk. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Triethanolamine	**Safe Work Australia (Australia, 10/2022). Skin sensitiser. Inhalation sensitiser.** TWA: 5 mg/m³ 8 hours.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Section 8. Exposure controls and personal protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid. [Hygroscopic.]

Colour : Colourless. Yellowish. Brown.

Odour : Characteristic.

Odour threshold : Not available.

pH : 10.5

Melting point/freezing point : 21.57°C

Boiling point, initial boiling point, and boiling range : 335.4°C (635.7°F)

Flash point : Closed cup: 185°C (365°F)

Evaporation rate : <0.005 (butyl acetate = 1)

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Lower: 3.6%
Upper: 7.2%

Vapour pressure : <0.0013 kPa (<0.01 mm Hg)

Relative vapour density : 5.1 [Air = 1]

Relative density : 1.1

: Not Available.

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : 324°C (615.2°F)

Decomposition temperature : 342.85 to 359.85°C

Viscosity : Dynamic: 590.5 cP

Explosive properties : Not available.

Section 9. Physical and chemical properties and safety characteristics

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Triethanolamine	LD50 Oral	Rat	7.39 g/kg	-

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Product/ingredient name	Category	Route of exposure	Target organs
Triethanolamine	Category 3	-	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Section 11. Toxicological information

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
Triethanolamine	Acute LC50 100000 µg/l Marine water	Crustaceans - *Crangon crangon* - Adult	48 hours
	Acute LC50 11800000 µg/l Fresh water	Fish - *Pimephales promelas*	96 hours
	Chronic NOEC 16000 µg/l Fresh water	Daphnia - *Daphnia magna*	21 days

Persistence and degradability

Not available.

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Triethanolamine	-1	<3.9	Low

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.		-	-	
ADG	Not regulated.		-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	-
ADG Class	No.	-
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

Section 15. Regulatory information

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

List name	Ingredient name	Status
Schedule III	Triethanolamine	Listed

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 2

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

Section 16. Any other relevant information

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : W.O.™ DEFOAM

Product code : 5048DF

ADG : -

Product type : Liquid.

Identified uses : Defoamer.

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 4
ACUTE TOXICITY (inhalation) - Category 4
SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A
SPECIFIC TARGET ORGAN TOXICITY - SINGLE EXPOSURE (Respiratory tract irritation) - Category 3

GHS label elements

Hazard pictograms :



GHS07

Section 2. Hazard(s) identification

Signal word : WARNING

Hazard statements : H227 - Combustible liquid.
H315 - Causes skin irritation.
H319 - Causes serious eye irritation.
H332 - Harmful if inhaled.
H335 - May cause respiratory irritation.

Precautionary statements

Prevention : Wear protective gloves: > 8 hours (breakthrough time): Butyl rubber gloves.. Wear eye or face protection. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Avoid breathing vapour. Wash thoroughly after handling.

Response : IF INHALED: Call a POISON CENTER or doctor if you feel unwell. Take off contaminated clothing and wash it before reuse. IF ON SKIN: Wash with plenty of water. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice or attention.

Storage : Store in a well-ventilated place. Keep container tightly closed.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P280, P210, P261, P264, P304 + P312, P362 + P364, P302 + P352, P305 + P351 + P338, P337 + P313, P403 + P233, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : None known.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
1-Hexanol, 2-ethyl-	60 - 100	104-76-7

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Section 4. First aid measures

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Harmful if inhaled. May cause respiratory irritation.

Skin contact : Causes skin irritation.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,pain or irritation,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : irritation,redness

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, alcohol-resistant foam or water spray (fog).

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical : Combustible liquid. Runoff to sewer may create fire or explosion hazard. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapour/gas is heavier than air and will spread along the ground. Vapours may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Section 5. Firefighting measures

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapour or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
1-Hexanol, 2-ethyl-	**ACGIH TLV (United States, 1/2023).** TWA: 5 ppm 8 hours.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): Butyl rubber gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Liquid. [Clear.]

Colour : Colourless.

Odour : Alcohol-like.

Odour threshold : Not available.

pH : Not available.

Melting point/freezing point : -89°C

Boiling point, initial boiling point, and boiling range : 184 to 185°C (363.2 to 365°F)

Flash point : Closed cup: 81°C (177.8°F)

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not available.

Vapour pressure : 0.027 kPa (0.2 mm Hg) at 20°C

Relative vapour density : 4.49 [Air = 1]

Relative density : 0.82 to 0.84 (20°C)

Solubility(ies) :

Media	Result
cold water	Very slightly soluble

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapour to accumulate in low or confined areas.

Incompatible materials : Reactive or incompatible with the following materials: oxidising materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
1-Hexanol, 2-ethyl-	LD50 Dermal LD50 Oral	Rat Rat	>3000 mg/kg 3290 mg/kg	- -

Conclusion/Summary : Harmful if inhaled. Adverse health effects could include the following: central nervous system depression

Irritation/Corrosion

Skin : May cause skin irritation.

Eyes : May cause eye irritation.

Respiratory : May cause respiratory irritation. Inhalation of the spray or mist may produce severe irritation of respiratory tract, characterised by coughing, choking or shortness of breath.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Product/ingredient name	Category	Route of exposure	Target organs
1-Hexanol, 2-ethyl-	Category 3	-	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Section 11. Toxicological information

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Harmful if inhaled. May cause respiratory irritation.

Skin contact : Causes skin irritation.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,pain or irritation,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : irritation,redness

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
1-Hexanol, 2-ethyl-	Acute LC50 75 mg/dm3 Fresh water	Fish - *Oncorhynchus mykiss* - Fry	96 hours
	Acute LC50 28200 µg/l Fresh water	Fish - *Pimephales promelas*	96 hours

Persistence and degradability

Product/ingredient name	Test	Result	Dose	Inoculum
1-Hexanol, 2-ethyl-	-	>99 % - Readily - 28 days	-	-

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
1-Hexanol, 2-ethyl-	-	-	Readily

Bioaccumulative potential

Section 12. Ecological information

Product/ingredient name	$LogP_{ow}$	BCF	Potential
1-Hexanol, 2-ethyl-	2.9	25.33	Low

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Vapour from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 18 December 2023

Version : 5

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Section 16. Any other relevant information

Classification	Justification
FLAMMABLE LIQUIDS - Category 4	On basis of test data
ACUTE TOXICITY (inhalation) - Category 4	Calculation method
SKIN CORROSION/IRRITATION - Category 2	Calculation method
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2A	Calculation method
SPECIFIC TARGET ORGAN TOXICITY - SINGLE EXPOSURE (Respiratory tract irritation) - Category 3	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

SAFETY DATA SHEET

XAN-PLEX™ D

Version 5

Section 1. Identification

Product identifier : XAN-PLEX™ D

Product code : 1171DF

ADG : -

Product type : Powder.

Identified uses : Viscosifier

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Section 2. Hazard(s) identification

Precautionary statements (Code) : -, -, -, -, -

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Mixture

There are no ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if symptoms occur. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Section 4. First aid measures

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides,sulfur oxides,metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : -

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Vacuum or sweep up material and place in a designated, labelled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Vacuum or sweep up material and place in a designated, labelled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid breathing dust. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

None.

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Section 8. Exposure controls and personal protection

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: > 8 hours (breakthrough time): Nitrile gloves. Neoprene gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: No personal respiratory protective equipment normally required.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : White. to Tan.

Odour : Faint odour.

Odour threshold : Not available.

pH : 7 [Conc. (% w/w): 5% - (H2O)]

Melting point/freezing point : Not available.

Boiling point, initial boiling point, and boiling range : >200°C (>392°F)

Flash point : Closed cup: Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : 1.55

Solubility(ies) :

Media	Result
cold water	Easily soluble

Partition coefficient: n-octanol/water : Not applicable.

Section 9. Physical and chemical properties and safety characteristics

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Section 11. Toxicological information

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the eyes.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : No known significant effects or critical hazards.

Product/ingredient name	Result	Species	Exposure
XAN-PLEX™ D	Acute LC50 179.15 ppm Marine water	Crustaceans - *Mysidopsis juniae*	96 hours
	Chronic LOEL 250 ppm Marine water	Echinodermata - *Lytechinus variegatus*	-
	Chronic NOEC 125 ppm Marine water	Echinodermata - *Lytechinus variegatus*	-

Persistence and degradability

Section 12. Ecological information

Not available.

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	Not regulated.	-	-	-	
ADG	Not regulated.	-	-	-	
IMDG	Not regulated.	-	-	-	
IATA	Not regulated.	-	-	-	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	No.	**Hazchem code** -
ADG Class	No.	**Hazchem code** -
IMDG Class	No.	-
IATA Class	No.	-

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Section 16. Any other relevant information

History

Date of printing : 23 February 2024.

Date of issue/Date of revision : 23 February 2024

Date of previous issue : 10 March 2023

Version : 5

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
Not classified.	

Section 16. Any other relevant information

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.

Section 1. Identification

Product identifier : ZINC OXIDE

Product code : 7857DF

ADG : ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (zinc oxide)

Product type : Powder.

Identified uses : Oxygen scavenger.

Supplier's details : Baker Hughes, Australia
631 Karel Avenue,
Jandakot,
Western Australia 6164,
Australia

Tel: 08 6595 7100

Emergency telephone number : CHEMTREC Emergency Telephone Numbers (Asia Pacific Region):
- Australia: (02) 9037 2994
- Brunei: +(65)-31581349 (Mandarin/English)
- China: 4001-204937 (Mandarin) *
- Hong Kong: 800-968-793 (Cantonese) *
- Indonesia: 001-803-017-9114 (Bahasa Indonesian) *
- Japan: 0800-300-5842 (Japanese)
- Malaysia: 1-800-815-308 (Bahasa Malay) *
- New Zealand: 9801 0034
- Philippines: 1-800-1-116-1020 (Tagalog) *
- PNG: +(61) 2 9037 2994
- Singapore: 800-101-2201 (Mandarin) *
- South Korea: 00-308-13-2549 (Korean) *
- Taiwan: 00801-14-8954 (Mandarin) *
- Thailand: 001-800-13-203-9987 (Thai) *
- Vietnam: +(84)-838012436 (Vietnamese)

- UK: +(44) 870-820-0418
- USA: +(1) 703-527-3887 (CHEMTREC International 24 hour)

* Number can only be dialled in-country

Section 2. Hazard(s) identification

Classification of the substance or mixture : SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2B
SHORT-TERM (ACUTE) AQUATIC HAZARD - Category 1
LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 1

GHS label elements

Hazard pictograms :



GHS09

Signal word : WARNING

Section 2. Hazard(s) identification

Hazard statements : H320 - Causes eye irritation.
H410 - Very toxic to aquatic life with long lasting effects.

Precautionary statements

Prevention : Avoid release to the environment.

Response : Collect spillage. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice or attention.

Storage : Not applicable.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Precautionary statements (Code) : -, P273, P391, P305 + P351 + P338, P337 + P313, -, P501

Supplemental label elements : Not applicable.

Other hazards which do not result in classification : May form combustible dust concentrations in air.

Additional information

Mixing of chemicals may create a reaction hazardous to one's health, to the environment, or a potential fire hazard.

Section 3. Composition and ingredient information

Substance/mixture : Substance

Ingredient name	% (w/w)	CAS number
zinc oxide	60 - 100	1314-13-2

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

The total concentration of ingredients in this product, reported or not in this section, is 100%.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Continue to rinse for at least 15 minutes. Check for and remove any contact lenses. If irritation persists, get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Section 4. First aid measures

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes eye irritation.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:,irritation,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Firefighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical powder.

Unsuitable extinguishing media : Avoid high pressure media which could cause the formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical : May form explosible dust-air mixture if dispersed. This material is very toxic to aquatic life with long lasting effects. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products : metal oxide/oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Hazchem code : •3Z

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities. Collect spillage.

Methods and material for containment and cleaning up

Small spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Avoid dust generation. Using a vacuum with HEPA filter will reduce dust dispersal. Place spilled material in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing dust. Avoid release to the environment. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Section 7. Handling and storage

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls and personal protection

The information in this section contains generic advice and guidance. Information is provided based on typical anticipated uses of the product. Additional measures might be required for bulk handling or other uses that could significantly increase worker exposure or environmental releases.

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
zinc oxide	**Safe Work Australia (Australia, 12/2019).** TWA: 10 mg/m³ 8 hours. Form: Dust STEL: 10 mg/m³ 15 minutes. Form: Fume TWA: 5 mg/m³ 8 hours. Form: Fume

Biological exposure indices

No exposure indices known.

Appropriate engineering controls : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapour or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Recommended: > 8 hours (breakthrough time): Nitrile gloves.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Section 8. Exposure controls and personal protection

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Recommended: If necessary half-face mask and particulate filter

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Information on basic physical and chemical properties

Appearance

Physical state : Solid. [Powder.]

Colour : White.

Odour : Not available.

Odour threshold : Not available.

pH : Not available.

Melting point/freezing point : 1975°C

Boiling point, initial boiling point, and boiling range : Not available.

Flash point : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : May be combustible at high temperature.

Lower and upper explosion limit/ flammability limit : Not applicable.

Vapour pressure : Not available.

Relative vapour density : Not applicable.

Relative density : Not available.

Not Available.

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not applicable.

Decomposition temperature : Not available.

Viscosity : Not available.

Explosive properties : Not available.

Oxidising properties : Not available.

Other information

Pour point : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Prevent dust accumulation.

Incompatible materials : Not available.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
zinc oxide	LD50 Oral LD Oral	Mouse Rat	7950 mg/kg >8437 mg/kg	- -

Conclusion/Summary : No known significant effects or critical hazards.

Irritation/Corrosion

Skin : No known significant effects or critical hazards.

Eyes : May cause eye irritation.

Respiratory : No known significant effects or critical hazards.

Sensitisation

Skin : No known significant effects or critical hazards.

Respiratory : No known significant effects or critical hazards.

Mutagenicity

Conclusion/Summary : No known significant effects or critical hazards.

Carcinogenicity

Conclusion/Summary : No known significant effects or critical hazards.

Reproductive toxicity

Conclusion/Summary : No known significant effects or critical hazards.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on likely routes of exposure : Not available.

Potential acute health effects

Section 11. Toxicological information

Eye contact : Causes eye irritation.

Inhalation : Exposure to airborne concentrations above statutory or recommended exposure limits may cause irritation of the nose, throat and lungs.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:,irritation,watering,redness

Inhalation : respiratory tract irritation,coughing

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

General : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Reproductive toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Toxicity : Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Product/ingredient name	Result	Species	Exposure
zinc oxide	Acute IC50 46 µg/l Fresh water	Algae - *Pseudokirchneriella subcapitata* - Exponential growth phase	72 hours
	Acute IC50 1.85 mg/l Marine water	Algae - *Skeletonema costatum*	96 hours
	Acute LC50 98 µg/l Fresh water	Daphnia - *Daphnia magna* - Neonate	48 hours
	Acute LC50 1.1 ppm Fresh water	Fish - *Oncorhynchus mykiss*	96 hours
	Acute LC50 2246000 µg/l Fresh water	Fish - *Pimephales promelas* - Neonate	96 hours

Persistence and degradability

Not available.

Section 12. Ecological information

Product/ingredient name	$LogP_{ow}$	BCF	Potential
zinc oxide	-	60960	High

Section 13. Disposal considerations

Disposal methods : Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Transport hazard class(es)	PG*	Label
ADR/RID	UN3077	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (zinc oxide)	9	III	
ADG	UN3077	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (zinc oxide)	9	III	
IMDG	UN3077	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (zinc oxide)	9	III	
IATA	UN3077	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (zinc oxide)	9	III	

PG* : Packing group

Regulatory information	Environmental hazards	Additional information
ADR/RID Class	Yes.	This product is not regulated as a dangerous good when transported in sizes of ≤5 L or ≤5 kg, provided the packagings meet the general provisions of 4.1.1.1, 4.1.1.2 and 4.1.1.4 to 4.1.1.8. **Tunnel code** (-)
ADG Class	Yes.	The product is not regulated as a dangerous good when transported by road or rail in either an IBC, or in other container types if ≤500 kg. This product is not regulated as a dangerous good when transported in sizes of ≤5 L or ≤5 kg, provided the packagings meet the general provisions of 4.1.1.1, 4.1.1.2 and 4.1.1.4 to 4.1.1.8. **Hazchem code** •3Z
IMDG Class	Yes.	This product is not regulated as a dangerous good when transported in sizes of ≤5 L or ≤5 kg, provided the packagings meet the general provisions of 4.1.1.1, 4.1.1.2 and 4.1.1.4 to 4.1.1.8. **Emergency schedules** F-A S-F

Section 14. Transport information

IATA Class	Yes.	This product is not regulated as a dangerous good when transported in sizes of ≤5 L or ≤5 kg, provided the packagings meet the general provisions of 5.0.2.4.1, 5.0.2.6.1.1 and 5.0.2.8.

Additional information**: A • in the Hazchem code indicates that Alcohol Resistant Foam is the preferred extinguishing medium. If not available, use the extinguishing medium indicated by the number in the Hazchem code.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

Standard for the Uniform Scheduling of Medicines and Poisons

Not regulated.

Model Work Health and Safety Regulations - Scheduled Substances

Australia inventory (AIIC) : All components are listed or exempted.

References : **National Code of Practice for the Control of Workplace Hazardous Substances.**

National Code of Practice for the Labelling of Workplace Substances.
National Code of Practice for the Preparation of Material Safety Data Sheets.
Approved Criteria for Classifying Hazardous Substances.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Additional information

Conforms to Brazil Regulation ABNT NBR 14725 (1-4) regarding the Global Harmonization System (GHS)

Section 16. Any other relevant information

History

Date of printing : 19 May 2024.

Date of issue/Date of revision : 19 May 2024

Date of previous issue : No previous validation

Version : 1

Section 16. Any other relevant information

Key to abbreviations : ADG = Australian Dangerous Goods
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
N/A = Not available
SGG = Segregation Group
SUSMP = Standard Uniform Schedule of Medicine and Poisons
UN = United Nations

Procedure used to derive the classification

Classification	Justification
SERIOUS EYE DAMAGE/EYE IRRITATION - Category 2B	Calculation method
SHORT-TERM (ACUTE) AQUATIC HAZARD - Category 1	Calculation method
LONG-TERM (CHRONIC) AQUATIC HAZARD - Category 1	Calculation method

References : Not available.

Indicates information that has changed from previously issued version.

Disclaimer

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