Appendix A: Change notice – Regulation 22

Interest holder	Tamboran B2 Pty Ltd	**EMP Title**	Beetaloo Sub-basin Shenandoah South E&A Program EMP	**Unique EMP ID**	TAM1-3	**Mod #**	4	**Date**	16 September 2024
Brief Description	Inclusion of additional stimulation fluids from supplier Fusion Technologies (Australia) Pty Ltd, used in hydraulic fracturing activities. A revised chemical risk assessment is included as Appendix E.2 to the Shenandoah South E&A EMP (TAM1-3).								
Geospatial files included?	N/A								

Does the proposed change result in a new, or increased, or potential or actual environmental impact or risk?	**If an INCREASE in the existing potential or actual environmental risk, is it provided for in the 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 compliances 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. There are no new or increased environmental impacts or risks through the addition of the new chemicals. All chemicals have been assessed to have a risk that is low and acceptable.	N/A No increased impact or risk with sufficient controls outlined in the spill management plan and wastewater management plan.	No. Existing mitigation measures are in place covering well construction and operations, spill management and wastewater management.	N/A. Stakeholder engagement is not required on the additional chemicals.	No. Environmental performance standards within the existing approved EMP are sufficient.	No. Activity covered under the existing AAPA certificates C2024-030 and C2024-031.	Yes Appendix A to the spill management plan (EMP Appendix F) has been updated to include the additional proposed chemical. All other plans remain valid and appropriate.	Yes. Mandatory groundwater monitoring required by the Code as outlined in *Table 34 Monitoring program summary*, will be met.

Additional contextual information	Inclusion of Fusion Technologies (Australia) Pty Ltd stimulation fluids to provide Tamboran greater flexibility around the selection of service providers for E&A well activities. Seven of the chemicals from the stimulation fluid recipe are proprietary. In accordance with s.105 of the *Industrial Chemical Act 2019*, for the proprietary chemicals, the CAS number and name have been redacted from the submission to protect the intellectual property of chemical manufacturer. Although the proprietary details of the chemical have been redacted in this report, AECOM had access to the chemical name and CAS number and the assessment of risk from the redacted chemical is presented in this report. Note: Where the stimulation chemical volumes have increased from previous assessments the new value is provided and highlighted in the tables. Where the volume assessed in the new CRA (Appendix E.2) is lower, the current volume remains. This is because a large proportion of chemicals in the stimulation fluids have previously been assessed.

Interest holder	Tamboran B2 Pty Ltd	EMP Title	Beetaloo Sub-basin Shenandoah South E&A Program EMP	Unique EMP ID	TAM1-3	Mod #	4	Date	16 September 2024

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Executive Summary

Table 6: Chemicals that may be added to the proppant during stimulation activities and held on each well pad, based on 3 wells per pad

Material name	Typical volume	Maximum volume	Unit	Storage area	Chemical composition	CAS Number	Chemical risk assessment report
Acetic acid - 60% pH control	3,000	9,000	L	Stimulation chemical storage area	Acetic acid	64-19-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
BE-9 biocide	17,000	17,000	L	Stimulation chemical storage area	Tributyl tetradecyl phosphonium chloride	81741-28-8	AECOM, 2024 – Appendix
Caustic soda liquid pH control/ buffer	15,000	45,000	L	Stimulation chemical storage area	Sodium hydroxide	1310-73-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
DCA-11001 breaker activator	5,000	15,000	L	Stimulation chemical storage area	Diethanolamine	111-42-2	AECOM, 2024 – Appendix E
DCA-13002 breaker	300	900	kg	Stimulation chemical storage area	Sodium persulfate	7775-27-1	AECOM, 2024 – Appendix E
DCA-13003 breaker	10,000	30,000	L	Stimulation chemical storage area	Chlorous acid, sodium salt Sodium chloride	7758-19-2 7647-14-5	AECOM, 2024 – Appendix E
DCA-16001 clay stabiliser	42,000	126,000	L	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DCA-17001 corrosion inhibitor	1,000	3,000	L	Stimulation chemical storage area	Diethylene glycol Cinnamaldehyde Amine oxides, cocoalkyldimethyl Methanol Benzaldehyde Alcohols, C12-16, ethoxylated Sodium iodide	111-46-6 104-55-2 61788-90-7 67-56-1 100-52-7 68551-12-2 7681-82-5	AECOM, 2024 – Appendix E

Amended EMP text

Executive Summary

Table 6: Chemicals that may be added to the proppant during stimulation activities and held on each well pad, based on 3 wells per pad

Material name	Typical volume	Maximum volume	Unit	Storage area	Chemical composition	CAS Number	Chemical risk assessment report
Stimulation chemical							
Acetic acid - 60% pH control	3,000	9,000	L	Stimulation chemical storage area	Acetic acid	64-19-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
BE-9 biocide	17,000	17,000	L	Stimulation chemical storage area	Tributyl tetradecyl phosphonium chloride	81741-28-8	AECOM, 2024 – Appendix
Caustic soda liquid - pH control/ buffer	15,000	45,000	L	Stimulation chemical storage area	Sodium hydroxide	1310-73-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
DCA-11001 breaker activator	5,000	15,000	L	Stimulation chemical storage area	Diethanolamine	111-42-2	AECOM, 2024 – Appendix E
DCA-13002 breaker	300	900	kg	Stimulation chemical storage area	Sodium persulfate	7775-27-1	AECOM, 2024 – Appendix E
DCA-13003 breaker	10,000	30,000	L	Stimulation chemical storage area	Chlorous acid, sodium salt Sodium chloride	7758-19-2 7647-14-5	AECOM, 2024 – Appendix E
DCA-16001 clay stabiliser	42,000	126,000	L	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DCA-17001 corrosion inhibitor	1,000	3,000	L	Stimulation chemical storage area	Diethylene glycol Cinnamaldehyde Amine oxides, cocoalkyldimethyl	111-46-6 104-55-2 61788-90-7 67-56-1	AECOM, 2024 – Appendix E

Interest holder	Tamboran B2 Pty Ltd	EMP Title	Beetaloo Sub-basin Shenandoah South E&A Program EMP	Unique EMP ID	TAM1-3	Mod #	4	Date	16 September 2024

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DCA-19001 crosslinker	600	1,800	kg	Stimulation chemical storage area	Disodium octaborate tetrahydrate	12008-41-2	AECOM, 2024 – Appendix E
DCA-19002 crosslinker	10,000	30,000	L	Stimulation chemical storage area	Ulexite Ethylene glycol Crystalline silica, quartz	1319-33-1 107-21-1 14808-60-7	AECOM, 2024 – Appendix E
DCA-23001 friction reducer	5,000	15,000	kg	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DCA-23003 friction reducer	18,000	54,000	L	Stimulation chemical storage area	Hydrotreated light petroleum distillate Ethoxylated branched C13 alcohol Sodium diacetate	64742-47-8 78330-21-9 126-96-5	AECOM, 2024 – Appendix E
DCA-25005 gelling agent	35,000	105,00	kg	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DCA-30001 scale Inhibitor	15,000	45,000	L	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DCA-32002 surfactant	15,000	45,000	L	Stimulation chemical storage area	Alcohols, C6-C12, ethoxylated propoxylated Alcohols, C10-C16, ethoxylated propoxylated	68937-66-6 69227-22-1	AECOM, 2024 – Appendix E
DCA-32014 surfactant	200	600	L	Stimulation chemical storage area	Hydrotreated light petroleum distillate Ethanol Fatty acids, tall-oil, ethoxylated C12-C15 Ethoxylated alcohols	64742-47-8 64-17-5 61791-00-2 68131-39-5 68155-20-4 71-36-3 67-56-1	AECOM, 2024 – Appendix E

Amended EMP text

					Methanol Benzaldehyde Alcohols, C12-16, ethoxylated Sodium iodide	100-52-7 68551-12-2 7681-82-5	
DCA-19001 crosslinker	600	1,800	kg	Stimulation chemical storage area	Disodium octaborate tetrahydrate	12008-41-2	AECOM, 2024 – Appendix E
DCA-19002 crosslinker	10,000	30,000	L	Stimulation chemical storage area	Ulexite Ethylene glycol Crystalline silica, quartz	1319-33-1 107-21-1 14808-60-7	AECOM, 2024 – Appendix E
DCA-23001 friction reducer	5,000	15,000	kg	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DCA-23003 friction reducer	18,000	54,000	L	Stimulation chemical storage area	Hydrotreated light petroleum distillate Ethoxylated branched C13 alcohol Sodium diacetate	64742-47-8 78330-21-9 126-96-5	AECOM, 2024 – Appendix E
DCA-25005 gelling agent	35,000	105,00	kg	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DCA-30001 scale Inhibitor	15,000	45,000	L	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DCA-32002 surfactant	15,000	45,000	L	Stimulation chemical storage area	Alcohols, C6-C12, ethoxylated propoxylated Alcohols, C10-C16, ethoxylated propoxylated	68937-66-6 69227-22-1	AECOM, 2024 – Appendix E
DCA-32014 surfactant	200	600	L	Stimulation chemical storage area	Hydrotreated light petroleum distillate Ethanol	64742-47-8 64-17-5 61791-00-2	AECOM, 2024 – Appendix E

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					Amides, tall-oil fatty, N,N-bis(hydroxyethyl) Butyl alcohol Methanol		
FE-2 buffer	200	600	kg	Stimulation chemical storage area	Citric acid	77-92-9	AECOM, 2024 – Appendix E
Hydrochloric acid - 32%	50,000	150,000	L	Stimulation chemical storage area	Hydrochloric acid (32%)	7647-01-0	AECOM, 2024 – Appendix E
Alcohols, C11-14-iso-, C13-rich, ethoxylated-surfactant	5,285	15,855	L	Stimulation chemical storage area	Alcohols, C11-14-iso-, C13-rich, ethoxylated	78330-21-9	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Sodium (C14-16) olefin sulfonate - surfactant	4,658	13,974	L	Stimulation chemical storage area	Sodium (C14-16) olefin sulfonate	68439-57-6	EHS Support, (2023) – Appendix E.1
Diisobutyl glutarate - plasticiser	627	1,881	L	Stimulation chemical storage area	Diisobutyl glutarate	71195-64-7	EHS Support, (2023) – Appendix E.1
Diisobutyl succinate - plasticiser	209	627	L	Stimulation chemical storage area	Diisobutyl succinate	925-06-4	EHS Support, (2023) – Appendix E.1
Diisobutyl adipate- plasticiser	179	537	L	Stimulation chemical storage area	Diisobutyl adipate	141-04-8	EHS Support, (2023) – Appendix E.1
Sodium thiosulphate- stabilising agent	4,763	14,289	L	Stimulation chemical storage area	Sodium thiosulphate	7772-98-7	EHS Support, (2023) – Appendix E.1
Sodium sulphate stabilising agent	913	2,739	L	Stimulation chemical storage area	Sodium sulphate	7757-82-6	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1

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					Fatty acids, tall-oil, ethoxylated C12-C15 Ethoxylated alcohols Amides, tall-oil fatty, N,N-bis(hydroxyethyl) Butyl alcohol Methanol	68131-39-5 68155-20-4 71-36-3 67-56-1	
FE-2 buffer	200	600	kg	Stimulation chemical storage area	Citric acid	77-92-9	AECOM, 2024 – Appendix E
Hydrochloric acid - 32%	50,000	150,000	L	Stimulation chemical storage area	Hydrochloric acid (32%)	7647-01-0	AECOM, 2024 – Appendix E
Alcohols, C11-14-iso-, C13-rich, ethoxylated-surfactant	5,285	15,855	L	Stimulation chemical storage area	Alcohols, C11-14-iso-, C13-rich, ethoxylated	78330-21-9	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Sodium (C14-16) olefin sulfonate - surfactant	4,658	13,974	L	Stimulation chemical storage area	Sodium (C14-16) olefin sulfonate	68439-57-6	EHS Support, (2023) – Appendix E.1
Diisobutyl glutarate - plasticiser	627	1,881	L	Stimulation chemical storage area	Diisobutyl glutarate	71195-64-7	EHS Support, (2023) – Appendix E.1
Diisobutyl succinate - plasticiser	209	627	L	Stimulation chemical storage area	Diisobutyl succinate	925-06-4	EHS Support, (2023) – Appendix E.1
Diisobutyl adipate- plasticiser	179	537	L	Stimulation chemical storage area	Diisobutyl adipate	141-04-8	EHS Support, (2023) – Appendix E.1
Sodium thiosulphate- stabilising agent	4,763	14,289	L	Stimulation chemical storage area	Sodium thiosulphate	7772-98-7	EHS Support, (2023) – Appendix E.1
Sodium sulphate stabilising agent	913	2,739	L	Stimulation chemical storage area	Sodium sulphate	7757-82-6	AECOM, 2024 – Appendix E EHS Support,

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Sodium sulphite stabilising agent	794	2,382	L	Stimulation chemical storage area	Sodium sulphite	7757-83-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Ethylene glycol-crosslinker	5,112	15,336	L	Stimulation chemical storage area	Ethylene glycol	107-21-1	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Choline chloride-clay stabiliser	10,301	30,903	L	Stimulation chemical storage area	Choline chloride	67-48-1	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Glutaraldehyde-biocide	14,930	44,790	L	Stimulation chemical storage area	Glutaraldehyde	111-30-8	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Ammonium sulphate-breaker	4,479	13,491	L	Stimulation chemical storage area	Ammonium sulphate	7783-20-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Polyacrylamide-friction reducer	4,479	13,491	L	Stimulation chemical storage area	Polyacrylamide	25085-02-3	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Sodium polyacrylate-gelling agent	746	2,238	L	Stimulation chemical storage area	Sodium polyacrylate	9003-04-7	AECOM, 2024 – Appendix E EHS Support, (2023) –

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							(2023) – Appendix E.1
Sodium sulphite stabilising agent	794	2,382	L	Stimulation chemical storage area	Sodium sulphite	7757-83-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Ethylene glycol-crosslinker Anti-freeze	8,416	25,247	L	Stimulation chemical storage area	Ethylene glycol	107-21-1	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Choline chloride- clay stabiliser / clay swelling control (2-hydroxy-N,N,N-trimethylethanaminium chloride)	67,750	203,250	L	Stimulation chemical storage area	Choline chloride	67-48-1	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Glutaraldehyde- biocide	14,930	44,790	L	Stimulation chemical storage area	Glutaraldehyde	111-30-8	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Ammonium sulphate-breaker	4,479	13,491	L	Stimulation chemical storage area	Ammonium sulphate	7783-20-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1

Interest holder	Tamboran B2 Pty Ltd	EMP Title	Beetaloo Sub-basin Shenandoah South E&A Program EMP	Unique EMP ID	TAM1-3	Mod #	4	Date	16 September 2024

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							Appendix E.1
Sodium bisulfite- stabiliser	149	447	L	Stimulation chemical storage area	Sodium bisulfite	7631-90-5	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Alkyl alcohol- surfactant	149	447	L	Stimulation chemical storage area	Alkyl alcohol	56-81-5	EHS Support, (2023) – Appendix E.1
2-Propenoic acid, homopolymer, ammonium salt- biocide	149	447	L	Stimulation chemical storage area	2-Propenoic acid, homopolymer, ammonium salt	9003-03-6	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Potassium persulfate-braker	149	447	L	Stimulation chemical storage area	Potassium persulfate	7727-21-1	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
2-Ethoxy-naphthalene-surfactant	149	447	L	Stimulation chemical storage area	2-Ethoxy-naphthalene	93-18-5	EHS Support, (2023) – Appendix E.1
Sodium gluconate- stabiliser	8,576	25,728	L	Stimulation chemical storage area	Sodium gluconate	527-07-1	EHS Support, (2023) – Appendix E.1
Boric acid- crosslinker	4,288	12,864	L	Stimulation chemical storage area	Boric acid	10043-35-3	EHS Support, (2023) – Appendix E.1
Potassium hydroxide- pH control	10,745	32,235	L	Stimulation chemical storage area	Potassium hydroxide	1310-58-3	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1

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Polyacrylamide- friction reducer	4,479	13,491	L	Stimulation chemical storage area	Polyacrylamide	25085-02-3	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Sodium polyacrylate- gelling agent	746	2,238	L	Stimulation chemical storage area	Sodium polyacrylate	9003-04-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Sodium bisulfite- stabiliser	149	447	L	Stimulation chemical storage area	Sodium bisulfite	7631-90-5	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Alkyl alcohol- surfactant	149	447	L	Stimulation chemical storage area	Alkyl alcohol	56-81-5	EHS Support, (2023) – Appendix E.1
2-Propenoic acid, homopolymer, ammonium salt- biocide	149	447	L	Stimulation chemical storage area	2-Propenoic acid, homopolymer, ammonium salt	9003-03-6	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Potassium persulfate- braker	149	447	L	Stimulation chemical storage area	Potassium persulfate	7727-21-1	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
2-Ethoxy-naphthalene-surfactant	149	447	L	Stimulation chemical storage area	2-Ethoxy-naphthalene	93-18-5	EHS Support, (2023) – Appendix E.1
Sodium gluconate- stabiliser	8,576	25,728	L	Stimulation chemical storage area	Sodium gluconate	527-07-1	EHS Support, (2023) – Appendix E.1

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Mannanase- crosslinker	2	6	L	Stimulation chemical storage area	Mannanase	37288-54-3	EHS Support, (2023) – Appendix E.1
Ammonium persulphate- breaker	7,451	22,353	L	Stimulation chemical storage area	Ammonium persulphate	7727-54-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Talc- buffer	384	1,152	L	Stimulation chemical storage area	Talc	14807-96-6	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Sodium bromate- breaker	50,441	151,323	L	Stimulation chemical storage area	Sodium bromate	7789-38-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Hepta sodium phosphonate- Emulsifier	3,176	9,528	L	Stimulation chemical storage area	Hepta sodium phosphonate	22042-96-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Distillates, hydrotreated light- friction reducer	54,231	162,693	L	Stimulation chemical storage area	Distillates, hydrotreated light	64742-47-8	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Guar gum- viscosity regulator	15,141	45,423	L	Stimulation chemical storage area	Guar gum	9000-30-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1

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Boric acid- crosslinker	4,288	12,864	L	Stimulation chemical storage area	Boric acid	10043-35-3	EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Potassium hydroxide- pH control	10,745	32,235	L	Stimulation chemical storage area	Potassium hydroxide	1310-58-3	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Mannanase- crosslinker	2	6	L	Stimulation chemical storage area	Mannanase	37288-54-3	EHS Support, (2023) – Appendix E.1
Ammonium persulphate- breaker Diammonium peroxidisulphate – Oxidizing viscosity breaker	7,451	22,353	L	Stimulation chemical storage area	Ammonium persulphate	7727-54-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Talc- buffer/ Filler for encapsulate	384	1,152	L	Stimulation chemical storage area	Talc, Magnesium Silicate	14807-96-6	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Sodium bromate- breaker	50,441	151,323	L	Stimulation chemical storage area	Sodium bromate	7789-38-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1

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Poly-oxyethylene nonylphenol ether- surfactant	4,466	13,398	L	Stimulation chemical storage area	Poly-oxyethylene nonylphenol ether	9016-45-9	EHS Support, (2023) – Appendix E.1
Quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with bentonite- biocide	4,466	13,398	L	Stimulation chemical storage area	Quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with bentonite	68953-58-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
1,6-Hexanediol- cross linker	447	1,341	L	Stimulation chemical storage area	1,6-Hexanediol	629-11-8	EHS Support, (2023) – Appendix E.1
Hydrochloric acid- pH control	44,715	134,145	L	Stimulation chemical storage area	Hydrochloric acid	7647-01-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
N-Benzyl-alkylpyridinium chloride- pH control	28	84	L	Stimulation chemical storage area	N-Benzyl-alkylpyridinium chloride	68909-18-2	EHS Support, (2023) – Appendix E.1
Formic acid- corrosion inhibitor	38	114	L	Stimulation chemical storage area	Formic acid	64-18-6	EHS Support, (2023) – Appendix E.1
Sodium erythorbate- scaler prohibitor	334	1,002	L	Stimulation chemical storage area	Sodium erythorbate	6381-77-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Citric acid- pH control	15,878	47,634	L	Stimulation chemical storage area	Citric acid	77-92-9	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1

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Hepta sodium phosphonate- Emulsifier	3,176	9,528	L	Stimulation chemical storage area	Hepta sodium phosphonate	22042-96-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Distillates, hydrotreated light- friction reducer/slurry agent	54,231	162,693	L	Stimulation chemical storage area	Distillates, hydrotreated light	64742-47-8	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Guar gum- viscosity regulator	15,141	45,423	L	Stimulation chemical storage area	Guar gum	9000-30-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Poly-oxyethylene nonylphenol ether- surfactant	4,466	13,398	L	Stimulation chemical storage area	Poly-oxyethylene nonylphenol ether	9016-45-9	EHS Support, (2023) – Appendix E.1
Quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with bentonite- biocide	4,466	13,398	L	Stimulation chemical storage area	Quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with bentonite	68953-58-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
1,6-Hexanediol- cross linker	447	1,341	L	Stimulation chemical storage area	1,6-Hexanediol	629-11-8	EHS Support, (2023) – Appendix E.1
Hydrochloric acid- pH control	44,715	134,145	L	Stimulation chemical storage area	Hydrochloric acid	7647-01-0	AECOM, 2024 – Appendix E EHS Support,

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Acetic acid- pH control	15,878	47,634	L	Stimulation chemical storage area	Acetic acid	64-19-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Isopropanol- clay management	83	249	L	Stimulation chemical storage area	Isopropanol	67-63-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Ethoxylated C12-C16 alcohol - surfactant	57	171	L	Stimulation chemical storage area	Ethoxylated C12-C16 alcohol	68551-12-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Ethoxylated decanol - surfactant	19	57	L	Stimulation chemical storage area	Ethoxylated decanol	26183-52-8	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Cinnamaldehyde-biocide	57	171	L	Stimulation chemical storage area	Cinnamaldehyde	104-55-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Ethoxylated tallow alkyl amine - surfactant	9	27	L	Stimulation chemical storage area	Ethoxylated tallow alkyl amine	61791-26-2	EHS Support, (2023) – Appendix E.1
Methanol-corrosion inhibitor	2	6	L	Stimulation chemical storage area	Methanol	67-56-1	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1

Amended EMP text

							(2023) – Appendix E.1
N-Benzyl-alkylpyridinium chloride- pH control	28	84	L	Stimulation chemical storage area	N-Benzyl-alkylpyridinium chloride	68909-18-2	EHS Support, (2023) – Appendix E.1
Formic acid- corrosion inhibitor	2,001	6,002	L	Stimulation chemical storage area	Formic acid	64-18-6	EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Sodium erythorbate-scaler prohibitor/Reducing Agent	2,001	6,002	L	Stimulation chemical storage area	Sodium erythorbate	6381-77-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Citric acid- pH control	15,878	47,634	L	Stimulation chemical storage area	Citric acid	77-92-9	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Acetic acid- pH Buffer	15,878	47,634	L	Stimulation chemical storage area	Acetic acid	64-19-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Isopropanol- clay management	83	249	L	Stimulation chemical storage area	Isopropanol	67-63-0	AECOM, 2024 – Appendix E EHS Support, (2023) –

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Polyacrylamide - friction reducer	49,093	147,279	L	Stimulation chemical storage area	Polyacrylamide	9003-05-08	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Polyethylene glycol trimethylnonyl ether - clay manager	87	261	L	Stimulation chemical storage area	Polyethylene glycol trimethylnonyl ether	127087-87-0	EHS Support, (2023) – Appendix E.1
Water in additive-stabiliser	66,804	200,412	L	Stimulation chemical storage area	Water in additive	7732-18-5	EHS Support, (2023) – Appendix E.1
Potassium sorbate food grade- corrosion inhibitor	14	42	L	Stimulation chemical storage area	Potassium sorbate	24634-61-5	EHS Support, (2023) – Appendix E.1
Mannanase (Mannan endo-1,4-beta-mannosidase)- cross linker	2	6	L	Stimulation chemical storage area	Mannanase (Mannan endo-1,4-beta-mannosidase)	37288-54-3	EHS Support, (2023) – Appendix E.1
Nonoxynol-9- surfactant	9	27	L	Stimulation chemical storage area	Nonoxynol-9	26571-11-9	EHS Support, (2023) – Appendix E.1
2-Ethylhexanol PO/EO polymer-stabiliser	9	27	L	Stimulation chemical storage area	2-Ethylhexanol PO/EO polymer	64366-70-7	EHS Support, (2023) – Appendix E.1
Corn oil- friction reducer	662	1,986	L	Stimulation chemical storage area	Corn oil	8001-30-7	EHS Support, (2023) – Appendix E.1
Sodium chloride-weighting agent	15,000	45,000	kg	Completion chemical storage area	Sodium chloride	7647-14-5	AECOM, 2024 – Appendix E
ALDACIDE G biocide	500	1,500	L	Completion chemical storage area	Glutaraldehyde Methanol	111-30-8 67-56-1	AECOM, 2024 – Appendix E
OXYGON Oxygen scavenger	100	300	kg	Completion chemical storage area	Contains no hazardous substances in concentrations above cut-off	Proprietary	AECOM, 2024 – Appendix E

Amended EMP text

							Appendix E.1
Ethoxylated C12-C16 alcohol - surfactant	57	171	L	Stimulation chemical storage area	Ethoxylated C12-C16 alcohol	68551-12-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Ethoxylated decanol - surfactant	19	57	L	Stimulation chemical storage area	Ethoxylated decanol	26183-52-8	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Cinnamaldehyde-biocide / Corrosion inhibitor	1,000	3,000	L	Stimulation chemical storage area	Cinnamaldehyde	104-55-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Ethoxylated tallow alkyl amine - surfactant	9	27	L	Stimulation chemical storage area	Ethoxylated tallow alkyl amine	61791-26-2	EHS Support, (2023) – Appendix E.1
Methanol- corrosion inhibitor	2	6	L	Stimulation chemical storage area	Methanol	67-56-1	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Polyacrylamide - friction reducer	49,093	147,279	L	Stimulation chemical storage area	Polyacrylamide	9003-05-08	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2004 – Appendix E.2

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					values according to the competent authority		
BARACOR 100 corrosion inhibitor	2,000	6,000	L	Completion chemical storage area	Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues Methanol Nitrilotriacetic acid, trisodium salt monohydrate	68909-77-3 67-56-1 5064-31-3	AECOM, 2024 – Appendix E
Sodium Hypochlorite 10 – 30% cleaner	10,000	30,000	L	Completion chemical storage area	Sodium hypochlorite Sodium Hydroxide Water	7681-52-9 1310-73-2 7732-18-5	AECOM, 2024 – Appendix E
CON-DET wetting agent	50	150	kg	Drilling chemical storage area	Amides, coco, N,N-bis (hydroxyethyl) Benzenesulfonic acid, dimethyl-, sodium salt Isopropanol Potassium pyrophosphate Potassium hydroxide	68603-42-9 1300-72-7 67-63-0 7320-34-5 1310-58-3	AECOM, 2024 – Appendix E
SAPP- sodium acid phosphate cement treatment	50	150	kg	Drilling chemical storage area	DISODIUM PYROPHOSPHATE	7758-16-9	AECOM, 2024 – Appendix E
Bentonite-lubricant	3,000	9,000	kg	Drilling chemical storage area	Crystalline silica, quartz Crystalline silica, cristobalite Crystalline silica, tridymite	14808-60-7 14464-46-1 15468-32-3	AECOM, 2024 – Appendix E
Caustic Soda-pH control	1,400	4,200	kg	Drilling chemical storage area	Sodium hydroxide	1310-73-2	AECOM, 2024 – Appendix E
EZ MUD DP or EZ MUD Liquid-drilling mud	2000	6,000	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
ALDACIDE G biocide	336	1,008	kg	Drilling chemical storage area	Glutaraldehyde Methanol	111-30-8 67-56-1	AECOM, 2024 – Appendix E

Amended EMP text

Polyethylene glycol trimethylnonyl ether - clay manager/ Emulsifier	748	2,243	L	Stimulation chemical storage area	Polyethylene glycol trimethylnonyl ether	127087-87-0	EHS Support, (2023) – Appendix E.1 AECOM, 2024 - Appendix E.2
Water in additive-stabiliser	66,804	200,412	L	Stimulation chemical storage area	Water in additive	7732-18-5	EHS Support, (2023) – Appendix E.1
Potassium sorbate food grade- corrosion inhibitor	14	42	L	Stimulation chemical storage area	Potassium sorbate	24634-61-5	EHS Support, (2023) – Appendix E.1
Mannanase (Mannan endo-1,4-beta-mannosidase)- cross linker	2	6	L	Stimulation chemical storage area	Mannanase (Mannan endo-1,4-beta-mannosidase)	37288-54-3	EHS Support, (2023) – Appendix E.1
Nonoxynol-9-surfactant/Emulsifier	51	153	L	Stimulation chemical storage area	Nonoxynol-9	26571-11-9	EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
2-Ethylhexanol PO/EO polymer- stabiliser	9	27	L	Stimulation chemical storage area	2-Ethylhexanol PO/EO polymer	64366-70-7	EHS Support, (2023) – Appendix E.1
Corn oil- friction reducer	662	1,986	L	Stimulation chemical storage area	Corn oil	8001-30-7	EHS Support, (2023) – Appendix E.1
Proprietary – SCI-1F Scale inhibitor	19,357	58,071	L	Stimulation chemical storage area	Based on the CRA, the chemical is of low concern to human health and the environment. Chemicals were PBT and calculated below the risk thresholds.	Proprietary	AECOM, 2024 – Appendix E.2

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STOPPIT loss of circulation material	1,000	3,000	kg	Drilling chemical storage area	Crystalline silica, quartz	14808-60-7	AECOM, 2024 – Appendix E
Soda Ash- drill mud conditioner	350	1,050	kg	Drilling chemical storage area	Sodium carbonate	497-19-8	AECOM, 2024 – Appendix E
BARACOR 100 corrosion inhibitor	250	750	kg	Drilling chemical storage area	Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues Methanol Nitrilotriacetic acid, trisodium salt monohydrate	68909-77-3 67-56-1 5064-31-3	AECOM, 2024 – Appendix E
Sodium chloride (flossy salt)- weighting agent and formation inhibitor	96,000	288,000	kg	Drilling chemical storage area	Sodium chloride	7647-14-5	AECOM, 2024 – Appendix E
Barite- weighting agent	500	1,500	kg	Drilling chemical storage area	Crystalline silica	14808-60-7	AECOM, 2024 – Appendix E
BARACARB loss of circulation material	500	1,500	kg	Drilling chemical storage area	Crystalline silica, quartz	14808-60-7	AECOM, 2024 – Appendix E
Citric acid- pH control	500	1,500	kg	Drilling chemical storage area	Citric acid	5949-29-1	AECOM, 2024 – Appendix E
BARADEFOAM HP drilling fluid/foam	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
Sodium bicarbonate- pH buffer	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
PERFORMATROL- polymer fluid system	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E

Amended EMP text

Proprietary – surface coating	44	131	L	Stimulation chemical storage area	Based on the CRA, the chemical is of low concern to human health and the environment. Chemicals were PBT and calculated below the risk thresholds.	Proprietary	AECOM, 2024 – Appendix E.2
Sodium carbonate – pH buffer	78.5	236	L	Stimulation chemical storage area	Sodium carbonate	497-19-8	AECOM, 2024 – Appendix E.2
Proprietary – improves surface and interfacial tension	292	876	L	Stimulation chemical storage area	Based on the CRA, the chemical is of low concern to human health and the environment. Chemicals were PBT and calculated below the risk thresholds.	Proprietary	AECOM, 2024 – Appendix E.2
Proprietary – surfactant	7,592	22,776	L	Stimulation chemical storage area	Based on the CRA, the chemical is of low concern to human health and the environment. Chemicals were PBT and calculated below the risk thresholds.	Proprietary	AECOM, 2024 – Appendix E.2
Alkyl Pyridines Quat – Corrosion inhibitor	128	384	L	Stimulation chemical storage area	Alkyl Pyridines Quat	68909-18-2	AECOM, 2024 – Appendix E.2
Polymer/s - Isotridecanol, ethoxylated – Emulsifier	5,742	17,225	L	Stimulation chemical storage area	Isotridecanol, ethoxylated	69011-36-5	AECOM, 2024 – Appendix E.2
HCL-15B – Hydrochloric acid Blend – mineral acid	76,201	228,603	L	Stimulation chemical storage area	Hydrochloric acid	7647-01-0	AECOM, 2024 – Appendix E.2
Proprietary - Emulsifier	8,614	25,842	L	Stimulation chemical storage area	Based on the CRA, the chemical is of low concern to human health and the environment. Chemicals were	Proprietary	AECOM, 2024 – Appendix E.2

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SOURSCAV- mud additive treat H2S contamination	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DRIL-N-SLIDE- casing lubricant	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
STEELSEAL- corrosion inhibitor	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BARAZAN D or BARAZAN D PLUS- viscosity increaser	4,150	12,450	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
PAC L loss of circulation material	2,300	6,900	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
Potassium chloride- weighting agent and formation inhibitor	22,500	67,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
QUIK-FREE – drilling additive	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E

Amended EMP text

					PBT and calculated below the risk thresholds.		
Didecyldimethyl-ammonium Chloride - Biocide	1,936	5,807	L	Stimulation chemical storage area	Didecyldimethyl-ammonium Chloride	7173-51-5	AECOM, 2024 – Appendix E.2
Benzalkonium Chloride – Biocide	1,936	5,807	L	Stimulation chemical storage area	Benzalkonium Chloride	8001-54-5	AECOM, 2024 – Appendix E.2
Proprietary – Improve surface and interfacial tension	1,022	3,066	L	Stimulation chemical storage area	Based on the CRA, the chemical is of low concern to human health and the environment. Chemicals were PBT and calculated below the risk thresholds.	Proprietary	AECOM, 2024 – Appendix E.2
Proprietary – Improve surface and interfacial tension	341	1,022	L	Stimulation chemical storage area	Based on the CRA, the chemical is of low concern to human health and the environment. Chemicals were PBT and calculated below the risk thresholds.	Proprietary	AECOM, 2024 – Appendix E.2
Completion chemicals							
Sodium chloride- weighting agent	15,000	45,000	kg	Completion chemical storage area	Sodium chloride	7647-14-5	AECOM, 2024 – Appendix E
ALDACIDE G biocide	500	1,500	L	Completion chemical storage area	Glutaraldehyde Methanol	111-30-8 67-56-1	AECOM, 2024 – Appendix E
OXYGON Oxygen scavenger	100	300	kg	Completion chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BARACOR 100 corrosion inhibitor	2,000	6,000	L	Completion chemical storage area	Ethanol, 2,2'-oxybis-, reaction products with ammonia,	68909-77-3 67-56-1 5064-31-3	AECOM, 2024 – Appendix E

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BAROFIBRE, BAROFIBRE super fine and BAROFIBRE coarse loss of circulation material	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BaraBlend-657 Loss of circulation material	500	1,500	kg	Drilling chemical storage area	Crystalline silica, quartz	14808-60-7	AECOM, 2024 – Appendix E
N-DRIL HT PLUS filtration control additive	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DEXTRID LTE filtration control additive	4,600	13,800	kg	Drilling chemical storage area	Tetrahydro-3,5-dimethyl-1,3,5-thiadiazine-2-thione	533-74-4	AECOM, 2024 – Appendix E
BARABUF pH buffer	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BDF 933 or BaraLube W-933 drilling lubricant	864	2,592	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BAROLIFT sweeping agent	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
OXYGON oxygen scavenger	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the	Proprietary	AECOM, 2024 – Appendix E

Amended EMP text

					morpholine derivatives residues Methanol Nitrilotriacetic acid, trisodium salt monohydrate		
Sodium Hypochlorite 10 – 30% cleaner	10,000	30,000	L	Completion chemical storage area	Sodium hypochlorite Sodium Hydroxide Water	7681-52-9 1310-73-2 7732-18-5	AECOM, 2024 – Appendix E
Drilling chemicals							
CON-DET wetting agent	50	150	kg	Drilling chemical storage area	Amides, coco, N,N-bis (hydroxyethyl) Benzenesulfonic acid, dimethyl-, sodium salt Isopropanol Potassium pyrophosphate Potassium hydroxide	68603-42-9 1300-72-7 67-63-0 7320-34-5 1310-58-3	AECOM, 2024 – Appendix E
SAPP- sodium acid phosphate cement treatment	50	150	kg	Drilling chemical storage area	DISODIUM PYROPHOSPHATE	7758-16-9	AECOM, 2024 – Appendix E
Bentonite- lubricant	3,000	9,000	kg	Drilling chemical storage area	Crystalline silica, quartz Crystalline silica, cristobalite Crystalline silica, tridymite	14808-60-7 14464-46-1 15468-32-3	AECOM, 2024 – Appendix E
Caustic Soda-pH control	1,400	4,200	kg	Drilling chemical storage area	Sodium hydroxide	1310-73-2	AECOM, 2024 – Appendix E
EZ MUD DP or EZ MUD Liquid- drilling mud	2000	6,000	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
ALDACIDE G biocide	336	1,008	kg	Drilling chemical storage area	Glutaraldehyde Methanol	111-30-8 67-56-1	AECOM, 2024 – Appendix E
STOPPIT loss of circulation material	1,000	3,000	kg	Drilling chemical storage area	Crystalline silica, quartz	14808-60-7	AECOM, 2024 – Appendix E
Soda Ash- drill mud conditioner	350	1,050	kg	Drilling chemical storage area	Sodium carbonate	497-19-8	AECOM, 2024 – Appendix E

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					competent authority		
ENVIRO-THIN filtration control additive	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
Lime pH buffer	500	1,500	kg	Drilling chemical storage area	Calcium hydroxide	1305-62-0	AECOM, 2024 – Appendix E
Calcium chloride	37,000	111,000	kg	Drilling chemical storage area	Calcium chloride	10043-52-4	AECOM, 2024 – Appendix E
Sodium bromide	8,160	24,480	kg	Drilling chemical storage area	Sodium bromide	7647-15-6	AECOM, 2024 – Appendix E
Evolube TR	14,500	43,500	L	Drilling chemical storage area	Triethylene glycol, monobutyl ether 2-Butoxyethanol Diethanolamine	143-22-6 111-76-2 111-42-2	AECOM, 2024 – Appendix E
Radiagreen EME	4,800	14,400	L	Drilling chemical storage area	Fatty esters Specialities	Proprietary	AECOM, 2024 – Appendix E
Radiagreen EBL	4,800	14,400	L	Drilling chemical storage area	Fatty esters Specialities	Proprietary	AECOM, 2024 – Appendix E
Polydrill	7,500	22,500	kg	Drilling chemical storage area	SULPHONATED ORGANIC POLYMER	Proprietary	AECOM, 2024 – Appendix E
Alpine spotting beads	1,000	3,000	kg	Drilling chemical storage area	Styrene	100-42-5	AECOM, 2024 – Appendix E
Barite- weighting agent	354,000	1,062,000	kg	Drilling chemical storage area	Barium sulfate Crystalline silica Mica-group minerals	7727-43-7 14808-60-7 12001-26-2	AECOM, 2024 – Appendix E
Bio-Paq high temp filtration control	1,134	3,402	kg	Drilling chemical storage area	Starch, carboxymethyl ether, sodium salt	9063-38-1	AECOM, 2024 – Appendix E
Brine-Pac XTS corrosion inhibitor	3,400	10,200	L	Drilling chemical storage area	2-methylbut-3-yn-2-ol	115-19-5	AECOM, 2024 – Appendix E
Calcium chloride - salinity	180,000	540,000	kg	Drilling chemical storage area	calcium chloride	10043-52-4	AECOM, 2024 – Appendix E

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BARACOR 100 corrosion inhibitor	250	750	kg	Drilling chemical storage area	Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues Methanol Nitrilotriacetic acid, trisodium salt monohydrate	68909-77-3 67-56-1 5064-31-3	AECOM, 2024 – Appendix E
Sodium chloride (flossy salt)- weighting agent and formation inhibitor	96,000	288,000	kg	Drilling chemical storage area	Sodium chloride	7647-14-5	AECOM, 2024 – Appendix E
Barite- weighting agent	500	1,500	kg	Drilling chemical storage area	Crystalline silica	14808-60-7	AECOM, 2024 – Appendix E
BARACARB loss of circulation material	500	1,500	kg	Drilling chemical storage area	Crystalline silica, quartz	14808-60-7	AECOM, 2024 – Appendix E
Citric acid- pH control	500	1,500	kg	Drilling chemical storage area	Citric acid	5949-29-1	AECOM, 2024 – Appendix E
BARADEFOAM HP drilling fluid/foam	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
Sodium bicarbonate- pH buffer	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
PERFORMATROL- polymer fluid system	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
SOURSCAV- mud additive treat H2S contamination	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according	Proprietary	AECOM, 2024 – Appendix E

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CF Desco deflocculant	2,270	6,810	kg	Drilling chemical storage area	Tannins, sulfo-methylated crystalline silica, respirable powder	68201-64-9 14808-60-7	AECOM, 2024 – Appendix E
Chek-Loss fibrous LCM	1,360	4,080	kg	Drilling chemical storage area	Cellulose	9004-34-6	AECOM, 2024 – Appendix E
Citric acid - pH control	1,360	4,080	L	Drilling chemical storage area	Citric acid	77-92-9	AECOM, 2024 – Appendix E
Ecco-Temp high temp extender	8,000	24,000	L	Drilling chemical storage area	Triethanolamine	102-71-6	AECOM, 2024 – Appendix E
Flowzan viscosifier	5,000	15,000	kg	Drilling chemical storage area	Contains no hazardous ingredients according to GHS.	N/A	AECOM, 2024 – Appendix E
Mil-Lime (Calcium hydroxide) alkalinity	1,361	4,080	L	Drilling chemical storage area	calcium di-hydroxide	1305-62-0	AECOM, 2024 – Appendix E
Magnesium oxide pH buffer	7,500	22,500	kg	Drilling chemical storage area	magnesium oxide	1309-48-4	AECOM, 2024 – Appendix E
Mil-bio SEA 98 biocide	1,800	5,400	L	Drilling chemical storage area	THPS	55566-30-8	AECOM, 2024 – Appendix E
Mil-carb LCM / bridging	5,000	15,000	kg	Drilling chemical storage area	Limestone crystalline silica, respirable powder	1317-65-3 14808-60-7	AECOM, 2024 – Appendix E
Milstarch filtration control	5,000	15,000	kg	Drilling chemical storage area	Starch	9005-25-8	AECOM, 2024 – Appendix E
Navi-Lube lubricant	16,650	49,950	L	Drilling chemical storage area	Distillates, (petroleum), hydrotreated light Diethylene glycol monobutyl ether Benzene, mono-C10-13-alkyl derivatives, fractionation bottoms, heavy ends, sulfonated, sodium salts Petroleum distillates, hydrotreated heavy naphthenic Benzenesulfonic acid, C10-14-alkyl	64742-47-8 112-34-5 148520-82-5 64742-52-5	AECOM, 2024 – Appendix E

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					to the competent authority		
DRIL-N-SLIDE- casing lubricant	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
STEELSEAL- corrosion inhibitor	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BARAZAN D or BARAZAN D PLUS- viscosity increaser	4,150	12,450	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
PAC L loss of circulation material	2,300	6,900	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
Potassium chloride- weighting agent and formation inhibitor	22,500	67,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
QUIK-FREE – drilling additive	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BAROFIBRE, BAROFIBRE super fine and BAROFIBRE coarse loss of circulation material	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according	Proprietary	AECOM, 2024 – Appendix E

Interest holder	Tamboran B2 Pty Ltd	EMP Title	Beetaloo Sub-basin Shenandoah South E&A Program EMP	Unique EMP ID	TAM1-3	Mod #	4	Date	16 September 2024

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					derivatives, sodium salts	69669-44-9	
New-Drill Plus shale stabiliser	1,000	3,000	kg	Drilling chemical storage area	2-Propenoic acid, polymer with 2-propenamide, sodium salt	25987-30-8	AECOM, 2024 – Appendix E
Noxygen XT oxygen scavenger	884	2,652	kg	Drilling chemical storage area	2,3-didehydro-3-O-sodio-D-erythro-hexono-1,4-lactone	6381-77-7	AECOM, 2024 – Appendix E
Ova Col 110 HC cloud point glycol	13,000	39,000	kg	Drilling chemical storage area	Glycol Ether	9004-77-7	AECOM, 2024 – Appendix E
Potassium chloride salt / shale stabiliser	41,000	123,000	kg	Drilling chemical storage area	potassium chloride	7447-40-7	AECOM, 2024 – Appendix E
Potassium hydroxide pH source	1,250	3,750	kg	Drilling chemical storage area	potassium hydroxide	1310-58-3	AECOM, 2024 – Appendix E
Pyro-Trol II HT filtration control	25	75	kg	Drilling chemical storage area	Copolymer of acrylamide and 2-acrylamide-2-2methyl propane sulfonic acid	Proprietary	AECOM, 2024 – Appendix E
Pyro-Vis II HT viscosifier	1,400	4,200	kg	Drilling chemical storage area	t-Butyl alcohol	75-65-0	AECOM, 2024 – Appendix E
Soda ash pH and hardness control	1,000	3,000	kg	Drilling chemical storage area	sodium carbonate	497-19-8	AECOM, 2024 – Appendix E
Sodium bicarbonate pH and hardness control	1,000	3,000	kg	Drilling chemical storage area	sodium hydrogen carbonate	144-55-8	AECOM, 2024 – Appendix E
Sodium chloride - salt	54,400	163,200	kg	Drilling chemical storage area	sodium chloride	7647-14-5	AECOM, 2024 – Appendix E
W.O. defoam defoamer	600	1,800	L	Drilling chemical storage area	1-Hexanol, 2-ethyl-	104-76-7	AECOM, 2024 – Appendix E
Xan-Plex D viscosifier	3,000	9,000	kg	Drilling chemical storage area	Contains no hazardous ingredients according to GHS.	N/A	AECOM, 2024 – Appendix E
TEQ-LUBE II - lubricant	14,400	43,200	kg	Drilling chemical storage area	Poly(oxy-1,2-ethanediyl),α-hydro-ω-hydroxy-Ethane-1,2-diol, ethoxylated	25322-68-3	AECOM, 2024 – Appendix E

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					to the competent authority		
BaraBlend-657 Loss of circulation material	500	1,500	kg	Drilling chemical storage area	Crystalline silica, quartz	14808-60-7	AECOM, 2024 – Appendix E
N-DRIL HT PLUS filtration control additive	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DEXTRID LTE filtration control additive	4,600	13,800	kg	Drilling chemical storage area	Tetrahydro-3,5-dimethyl-1,3,5-thiadiazine-2-thione	533-74-4	AECOM, 2024 – Appendix E
BARABUF pH buffer	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BDF 933 or BaraLube W-933 drilling lubricant	864	2,592	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BAROLIFT sweeping agent	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
OXYGON oxygen scavenger	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
ENVIRO-THIN filtration control additive	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in	Proprietary	AECOM, 2024 – Appendix E

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TEQ-LUBE II - lubricant	14,400	43,200	kg	Drilling chemical storage area	Poly(oxy-1,2-ethanediyl), α-(9Z)-9-octadecen-1-yl-ω-hydroxy-, phosphate	39464-69-2	AECOM, 2024 – Appendix E
NEW-THIN – Polymeric thinner	4,680	14,040	kg	Drilling chemical storage area	Contains no hazardous ingredients according to GHS.	N/A	AECOM, 2024 – Appendix E
LC-LUBE - lubricant (graphite)	9,090	27,270	kg	Drilling chemical storage area	Natural graphite	7782-42-5	AECOM, 2024 – Appendix E
Proppants*							
100 mesh sand-proppant	91,000	273,000	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Quartz or organophilic phyllosilicate-proppant	1,084	3,252	L	Stimulation chemical storage area	Quartz or organophilic phyllosilicate	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
40/70 sand-proppant	,650,000	4,950,000	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
30/50 sand-proppant	610,000	1,830,000	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 as 20/40

* Proppants are sand which is inert. They do not require special chemical bunding but are co-located in the stimulation chemical storage area, within the well pad bund. Residual proppant from a stimulation campaign is often used to assist with chemical spills on the well pad, where contaminated spill material is removed.

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					concentrations above cut-off values according to the competent authority		
Lime pH buffer	500	1,500	kg	Drilling chemical storage area	Calcium hydroxide	1305-62-0	AECOM, 2024 – Appendix E
Calcium chloride	37,000	111,000	kg	Drilling chemical storage area	Calcium chloride	10043-52-4	AECOM, 2024 – Appendix E
Sodium bromide	8,160	24,480	kg	Drilling chemical storage area	Sodium bromide	7647-15-6	AECOM, 2024 – Appendix E
Evolube TR	14,500	43,500	L	Drilling chemical storage area	Triethylene glycol, monobutyl ether 2-Butoxyethanol Diethanolamine	143-22-6 111-76-2 111-42-2	AECOM, 2024 – Appendix E
Radiagreen EME	4,800	14,400	L	Drilling chemical storage area	Fatty esters Specialities	Proprietary	AECOM, 2024 – Appendix E
Radiagreen EBL	4,800	14,400	L	Drilling chemical storage area	Fatty esters Specialities	Proprietary	AECOM, 2024 – Appendix E
Polydrill	7,500	22,500	kg	Drilling chemical storage area	SULPHONATED ORGANIC POLYMER	Proprietary	AECOM, 2024 – Appendix E
Alpine spotting beads	1,000	3,000	kg	Drilling chemical storage area	Styrene	100-42-5	AECOM, 2024 – Appendix E
Barite- weighting agent	354,000	1,062,000	kg	Drilling chemical storage area	Barium sulfate Crystalline silica Mica-group minerals	7727-43-7 14808-60-7 12001-26-2	AECOM, 2024 – Appendix E
Bio-Paq high temp filtration control	1,134	3,402	kg	Drilling chemical storage area	Starch, carboxymethyl ether, sodium salt	9063-38-1	AECOM, 2024 – Appendix E
Brine-Pac XTS corrosion inhibitor	3,400	10,200	L	Drilling chemical storage area	2-methylbut-3-yn-2-ol	115-19-5	AECOM, 2024 – Appendix E
Calcium chloride - salinity	180,000	540,000	kg	Drilling chemical storage area	calcium chloride	10043-52-4	AECOM, 2024 – Appendix E
CF Desco deflocculant	2,270	6,810	kg	Drilling chemical storage area	Tannins, sulfo-methylated crystalline silica, respirable powder	68201-64-9 14808-60-7	AECOM, 2024 – Appendix E

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Chek-Loss fibrous LCM	1,360	4,080	kg	Drilling chemical storage area	Cellulose	9004-34-6	AECOM, 2024 – Appendix E
Citric acid - pH control	1,360	4,080	L	Drilling chemical storage area	Citric acid	77-92-9	AECOM, 2024 – Appendix E
Ecco-Temp high temp extender	8,000	24,000	L	Drilling chemical storage area	Triethanolamine	102-71-6	AECOM, 2024 – Appendix E
Flowzan viscosifier	5,000	15,000	kg	Drilling chemical storage area	Contains no hazardous ingredients according to GHS.	N/A	AECOM, 2024 – Appendix E
Mil-Lime (Calcium hydroxide) alkalinity	1,361	4,080	L	Drilling chemical storage area	calcium di-hydroxide	1305-62-0	AECOM, 2024 – Appendix E
Magnesium oxide pH buffer	7,500	22,500	kg	Drilling chemical storage area	magnesium oxide	1309-48-4	AECOM, 2024 – Appendix E
Mil-bio SEA 98 biocide	1,800	5,400	L	Drilling chemical storage area	THPS	55566-30-8	AECOM, 2024 – Appendix E
Mil-carb LCM / bridging	5,000	15,000	kg	Drilling chemical storage area	Limestone crystalline silica, respirable powder	1317-65-3 14808-60-7	AECOM, 2024 – Appendix E
Milstarch filtration control	5,000	15,000	kg	Drilling chemical storage area	Starch	9005-25-8	AECOM, 2024 – Appendix E
Navi-Lube lubricant	16,650	49,950	L	Drilling chemical storage area	Distillates, (petroleum), hydrotreated light Diethylene glycol monobutyl ether Benzene, mono-C10-13-alkyl derivatives, fractionation bottoms, heavy ends, sulfonated, sodium salts Petroleum distillates, hydrotreated heavy naphthenic Benzenesulfonic acid, C10-14-alkyl derivatives, sodium salts	64742-47-8 112-34-5 148520-82-5 64742-52-5 69669-44-9	AECOM, 2024 – Appendix E

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New-Drill Plus shale stabiliser	1,000	3,000	kg	Drilling chemical storage area	2-Propenoic acid, polymer with 2-propenamide, sodium salt	25987-30-8	AECOM, 2024 – Appendix E
Noxygen XT oxygen scavenger	884	2,652	kg	Drilling chemical storage area	2,3-didehydro-3-O-sodio-D-erythro-hexono-1,4-lactone	6381-77-7	AECOM, 2024 – Appendix E
Ova Col 110 HC cloud point glycol	13,000	39,000	kg	Drilling chemical storage area	Glycol Ether	9004-77-7	AECOM, 2024 – Appendix E
Potassium chloride salt / shale stabiliser	41,000	123,000	kg	Drilling chemical storage area	potassium chloride	7447-40-7	AECOM, 2024 – Appendix E
Potassium hydroxide pH source	1,250	3,750	kg	Drilling chemical storage area	potassium hydroxide	1310-58-3	AECOM, 2024 – Appendix E
Pyro-Trol II HT filtration control	25	75	kg	Drilling chemical storage area	Copolymer of acrylamide and 2-acrylamide-2-2methyl propane sulfonic acid	Proprietary	AECOM, 2024 – Appendix E
Pyro-Vis II HT viscosifier	1,400	4,200	kg	Drilling chemical storage area	t-Butyl alcohol	75-65-0	AECOM, 2024 – Appendix E
Soda ash pH and hardness control	1,000	3,000	kg	Drilling chemical storage area	sodium carbonate	497-19-8	AECOM, 2024 – Appendix E
Sodium bicarbonate pH and hardness control	1,000	3,000	kg	Drilling chemical storage area	sodium hydrogen carbonate	144-55-8	AECOM, 2024 – Appendix E
Sodium chloride - salt	54,400	163,200	kg	Drilling chemical storage area	sodium chloride	7647-14-5	AECOM, 2024 – Appendix E
W.O. defoam defoamer	600	1,800	L	Drilling chemical storage area	1-Hexanol, 2-ethyl-	104-76-7	AECOM, 2024 – Appendix E
Xan-Plex D viscosifier	3,000	9,000	kg	Drilling chemical storage area	Contains no hazardous ingredients according to GHS.	N/A	AECOM, 2024 – Appendix E
TEQ-LUBE II - lubricant	14,400	43,200	kg	Drilling chemical storage area	Poly(oxy-1,2-ethanediyl),α-hydro-ω-hydroxy-Ethane-1,2-diol, ethoxylated	25322-68-3	AECOM, 2024 – Appendix E
TEQ-LUBE II - lubricant	14,400	43,200	kg	Drilling chemical storage area	Poly(oxy-1,2-ethanediyl), α-(9Z)-9-octadecen-1-yl-ω-hydroxy-, phosphate	39464-69-2	AECOM, 2024 – Appendix E

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NEW-THIN – Polymeric thinner	4,680	14,040	kg	Drilling chemical storage area	Contains no hazardous ingredients according to GHS.	N/A	AECOM, 2024 – Appendix E
LC-LUBE -lubricant (graphite)	9,090	27,270	kg	Drilling chemical storage area	Natural graphite	7782-42-5	AECOM, 2024 – Appendix E
Proppants*							
100 mesh sand- proppant	91,000	273,000	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Quartz or organophilic phyllosilicate- proppant	1,084	3,252	L	Stimulation chemical storage area	Quartz or organophilic phyllosilicate	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
40/70 sand- proppant	,650,000	4,950,000	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
30/50 sand- proppant	610,000	1,830,000	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 as 20/40
Silicon dioxide (quartz/sand) 100 sand	4,757,614	14,272,842	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E.2
Silicon dioxide (quartz/sand) 40/70	5,435,287	16,305,860	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E.2
* Proppants are sand which is inert. They do not require special chemical bunding but are co-located in the stimulation chemical storage area, within the well pad bund. Residual proppant from a stimulation campaign is often used to assist with chemical spills on the well pad, where contaminated spill material is removed.							

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3.11 Chemical and fluid management

3.11.1 Chemical types and quantities

Table 19: Estimated chemical volume and storage used in the drilling and stimulation process at each site

Material name	Typical volume	Maximum volume	Unit	Storage area	Chemical composition	CAS Number	Chemical risk assessment report
Acetic acid - 60% pH control	3,000	9,000	L	Stimulation chemical storage area	Acetic acid	64-19-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
BE-9 biocide	17,000	17,000	L	Stimulation chemical storage area	Tributyl tetradecyl phosphonium chloride	81741-28-8	AECOM, 2024 – Appendix
Caustic soda liquid pH control/ buffer	15,000	45,000	L	Stimulation chemical storage area	Sodium hydroxide	1310-73-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
DCA-11001 breaker activator	5,000	15,000	L	Stimulation chemical storage area	Diethanolamine	111-42-2	AECOM, 2024 – Appendix E
DCA-13002 breaker	300	900	kg	Stimulation chemical storage area	Sodium persulfate	7775-27-1	AECOM, 2024 – Appendix E
DCA-13003 breaker	10,000	30,000	L	Stimulation chemical storage area	Chlorous acid, sodium salt Sodium chloride	7758-19-2 7647-14-5	AECOM, 2024 – Appendix E
DCA-16001 clay stabiliser	42,000	126,000	L	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E

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Cleaning Chemicals and Spill Response							
Soda ash – sodium carbonate	3,750	11,250	kg	Stimulation chemical storage area	Sodium carbonate - spill response in event acid spill	497-19-8	AECOM, 2024 – Appendix E.2
Flush fluid - distillates (petroleum), hydrotreated	1,500	4,500	L	Stimulation chemical storage area	Distillates (petroleum), hydrotreated - equipment cleaning	64742-47-8	AECOM, 2024 – Appendix E.2

3.11 Chemical and fluid management

3.11.1 Chemical types and quantities

Table 19: Estimated chemical volume and storage used in the drilling and stimulation process at each site

Material name	Typical volume	Maximum volume	Unit	Storage area	Chemical composition	CAS Number	Chemical risk assessment report
Stimulation chemical							
Acetic acid - 60% pH control	3,000	9,000	L	Stimulation chemical storage area	Acetic acid	64-19-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
BE-9 biocide	17,000	17,000	L	Stimulation chemical storage area	Tributyl tetradecyl phosphonium chloride	81741-28-8	AECOM, 2024 – Appendix
Caustic soda liquid - pH control/ buffer	15,000	45,000	L	Stimulation chemical storage area	Sodium hydroxide	1310-73-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
DCA-11001 breaker activator	5,000	15,000	L	Stimulation chemical storage area	Diethanolamine	111-42-2	AECOM, 2024 – Appendix E
DCA-13002 breaker	300	900	kg	Stimulation chemical storage area	Sodium persulfate	7775-27-1	AECOM, 2024 – Appendix E
DCA-13003 breaker	10,000	30,000	L	Stimulation chemical storage area	Chlorous acid, sodium salt Sodium chloride	7758-19-2 7647-14-5	AECOM, 2024 – Appendix E

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DCA-17001 corrosion inhibitor	1,000	3,000	L	Stimulation chemical storage area	Diethylene glycol Cinnamaldehyde Amine oxides, cocoalkyldimethyl Methanol Benzaldehyde Alcohols, C12-16, ethoxylated Sodium iodide	111-46-6 104-55-2 61788-90-7 67-56-1 100-52-7 68551-12-2 7681-82-5	AECOM, 2024 – Appendix E
DCA-19001 crosslinker	600	1,800	kg	Stimulation chemical storage area	Disodium octaborate tetrahydrate	12008-41-2	AECOM, 2024 – Appendix E
DCA-19002 crosslinker	10,000	30,000	L	Stimulation chemical storage area	Ulexite Ethylene glycol Crystalline silica, quartz	1319-33-1 107-21-1 14808-60-7	AECOM, 2024 – Appendix E
DCA-23001 friction reducer	5,000	15,000	kg	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DCA-23003 friction reducer	18,000	54,000	L	Stimulation chemical storage area	Hydrotreated light petroleum distillate Ethoxylated branched C13 alcohol Sodium diacetate	64742-47-8 78330-21-9 126-96-5	AECOM, 2024 – Appendix E
DCA-25005 gelling agent	35,000	105,00	kg	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DCA-30001 scale Inhibitor	15,000	45,000	L	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DCA-32002 surfactant	15,000	45,000	L	Stimulation chemical storage area	Alcohols, C6-C12, ethoxylated propoxylated	68937-66-6 69227-22-1	AECOM, 2024 – Appendix E

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DCA-16001 clay stabiliser	42,000	126,000	L	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DCA-17001 corrosion inhibitor	1,000	3,000	L	Stimulation chemical storage area	Diethylene glycol Cinnamaldehyde Amine oxides, cocoalkyldimethyl Methanol Benzaldehyde Alcohols, C12-16, ethoxylated Sodium iodide	111-46-6 104-55-2 61788-90-7 67-56-1 100-52-7 68551-12-2 7681-82-5	AECOM, 2024 – Appendix E
DCA-19001 crosslinker	600	1,800	kg	Stimulation chemical storage area	Disodium octaborate tetrahydrate	12008-41-2	AECOM, 2024 – Appendix E
DCA-19002 crosslinker	10,000	30,000	L	Stimulation chemical storage area	Ulexite Ethylene glycol Crystalline silica, quartz	1319-33-1 107-21-1 14808-60-7	AECOM, 2024 – Appendix E
DCA-23001 friction reducer	5,000	15,000	kg	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DCA-23003 friction reducer	18,000	54,000	L	Stimulation chemical storage area	Hydrotreated light petroleum distillate Ethoxylated branched C13 alcohol Sodium diacetate	64742-47-8 78330-21-9 126-96-5	AECOM, 2024 – Appendix E
DCA-25005 gelling agent	35,000	105,00	kg	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DCA-30001 scale Inhibitor	15,000	45,000	L	Stimulation chemical storage area	Contains no hazardous substances in concentrations above cut-off values according	Proprietary	AECOM, 2024 – Appendix E

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					Alcohols, C10-C16, ethoxylated propoxylated		
DCA-32014 surfactant	200	600	L	Stimulation chemical storage area	Hydrotreated light petroleum distillate Ethanol Fatty acids, tall-oil, ethoxylated C12-C15 Ethoxylated alcohols Amides, tall-oil fatty, N,N-bis(hydroxyethyl) Butyl alcohol Methanol	64742-47-8 64-17-5 61791-00-2 68131-39-5 68155-20-4 71-36-3 67-56-1	AECOM, 2024 – Appendix E
FE-2 buffer	200	600	kg	Stimulation chemical storage area	Citric acid	77-92-9	AECOM, 2024 – Appendix E
Hydrochloric acid - 32%	50,000	150,000	L	Stimulation chemical storage area	Hydrochloric acid (32%)	7647-01-0	AECOM, 2024 – Appendix E
Alcohols, C11-14-iso-, C13-rich, ethoxylated-surfactant	5,285	15,855	L	Stimulation chemical storage area	Alcohols, C11-14-iso-, C13-rich, ethoxylated	78330-21-9	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Sodium (C14-16) olefin sulfonate - surfactant	4,658	13,974	L	Stimulation chemical storage area	Sodium (C14-16) olefin sulfonate	68439-57-6	EHS Support, (2023) – Appendix E.1
Diisobutyl glutarate - plasticiser	627	1,881	L	Stimulation chemical storage area	Diisobutyl glutarate	71195-64-7	EHS Support, (2023) – Appendix E.1
Diisobutyl succinate - plasticiser	209	627	L	Stimulation chemical storage area	Diisobutyl succinate	925-06-4	EHS Support, (2023) – Appendix E.1
Diisobutyl adipate- plasticiser	179	537	L	Stimulation chemical storage area	Diisobutyl adipate	141-04-8	EHS Support, (2023) – Appendix E.1
Sodium thiosulphate- stabilising agent	4,763	14,289	L	Stimulation chemical storage area	Sodium thiosulphate	7772-98-7	EHS Support, (2023) – Appendix E.1
Sodium sulphate stabilising agent	913	2,739	L	Stimulation chemical storage area	Sodium sulphate	7757-82-6	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1

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					to the competent authority		
DCA-32002 surfactant	15,000	45,000	L	Stimulation chemical storage area	Alcohols, C6-C12, ethoxylated propoxylated Alcohols, C10-C16, ethoxylated propoxylated	68937-66-6 69227-22-1	AECOM, 2024 – Appendix E
DCA-32014 surfactant	200	600	L	Stimulation chemical storage area	Hydrotreated light petroleum distillate Ethanol Fatty acids, tall-oil, ethoxylated C12-C15 Ethoxylated alcohols Amides, tall-oil fatty, N,N-bis(hydroxyethyl) Butyl alcohol Methanol	64742-47-8 64-17-5 61791-00-2 68131-39-5 68155-20-4 71-36-3 67-56-1	AECOM, 2024 – Appendix E
FE-2 buffer	200	600	kg	Stimulation chemical storage area	Citric acid	77-92-9	AECOM, 2024 – Appendix E
Hydrochloric acid - 32%	50,000	150,000	L	Stimulation chemical storage area	Hydrochloric acid (32%)	7647-01-0	AECOM, 2024 – Appendix E
Alcohols, C11-14-iso-, C13-rich, ethoxylated-surfactant	5,285	15,855	L	Stimulation chemical storage area	Alcohols, C11-14-iso-, C13-rich, ethoxylated	78330-21-9	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Sodium (C14-16) olefin sulfonate - surfactant	4,658	13,974	L	Stimulation chemical storage area	Sodium (C14-16) olefin sulfonate	68439-57-6	EHS Support, (2023) – Appendix E.1
Diisobutyl glutarate - plasticiser	627	1,881	L	Stimulation chemical storage area	Diisobutyl glutarate	71195-64-7	EHS Support, (2023) – Appendix E.1
Diisobutyl succinate - plasticiser	209	627	L	Stimulation chemical storage area	Diisobutyl succinate	925-06-4	EHS Support, (2023) – Appendix E.1
Diisobutyl adipate- plasticiser	179	537	L	Stimulation chemical storage area	Diisobutyl adipate	141-04-8	EHS Support,

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Sodium sulphite stabilising agent	794	2,382	L	Stimulation chemical storage area	Sodium sulphite	7757-83-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Ethylene glycol-crosslinker	5,112	15,336	L	Stimulation chemical storage area	Ethylene glycol	107-21-1	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Choline chloride-clay stabiliser	10,301	30,903	L	Stimulation chemical storage area	Choline chloride	67-48-1	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Glutaraldehyde-biocide	14,930	44,790	L	Stimulation chemical storage area	Glutaraldehyde	111-30-8	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Ammonium sulphate- breaker	4,479	13,491	L	Stimulation chemical storage area	Ammonium sulphate	7783-20-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Polyacrylamide-friction reducer	4,479	13,491	L	Stimulation chemical storage area	Polyacrylamide	25085-02-3	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Sodium polyacrylate-gelling agent	746	2,238	L	Stimulation chemical storage area	Sodium polyacrylate	9003-04-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Sodium bisulfite-stabiliser	149	447	L	Stimulation chemical storage area	Sodium bisulfite	7631-90-5	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Alkyl alcohol-surfactant	149	447	L	Stimulation chemical storage area	Alkyl alcohol	56-81-5	EHS Support, (2023) – Appendix E.1

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							(2023) – Appendix E.1
Sodium thiosulphate-stabilising agent	4,763	14,289	L	Stimulation chemical storage area	Sodium thiosulphate	7772-98-7	EHS Support, (2023) – Appendix E.1
Sodium sulphate stabilising agent	913	2,739	L	Stimulation chemical storage area	Sodium sulphate	7757-82-6	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Sodium sulphite stabilising agent	794	2,382	L	Stimulation chemical storage area	Sodium sulphite	7757-83-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Ethylene glycol-crosslinker Anti-freeze	8,416	25,247	L	Stimulation chemical storage area	Ethylene glycol	107-21-1	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Choline chloride- clay stabiliser / clay swelling control (2-hydroxy-N,N,N-trimethylethanaminium chloride)	67,750	203,250	L	Stimulation chemical storage area	Choline chloride	67-48-1	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Glutaraldehyde- biocide	14,930	44,790	L	Stimulation chemical storage area	Glutaraldehyde	111-30-8	AECOM, 2024 – Appendix E EHS Support, (2023) –

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2-Propenoic acid, homopolymer, ammonium salt- biocide	149	447	L	Stimulation chemical storage area	2-Propenoic acid, homopolymer, ammonium salt	9003-03-6	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Potassium persulfate-braker	149	447	L	Stimulation chemical storage area	Potassium persulfate	7727-21-1	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
2-Ethoxy-naphthalene- surfactant	149	447	L	Stimulation chemical storage area	2-Ethoxy-naphthalene	93-18-5	EHS Support, (2023) – Appendix E.1
Sodium gluconate- stabiliser	8,576	25,728	L	Stimulation chemical storage area	Sodium gluconate	527-07-1	EHS Support, (2023) – Appendix E.1
Boric acid- crosslinker	4,288	12,864	L	Stimulation chemical storage area	Boric acid	10043-35-3	EHS Support, (2023) – Appendix E.1
Potassium hydroxide- pH control	10,745	32,235	L	Stimulation chemical storage area	Potassium hydroxide	1310-58-3	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Mannanase- crosslinker	2	6	L	Stimulation chemical storage area	Mannanase	37288-54-3	EHS Support, (2023) – Appendix E.1
Ammonium persulphate- breaker	7,451	22,353	L	Stimulation chemical storage area	Ammonium persulphate	7727-54-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Talc- buffer	384	1,152	L	Stimulation chemical storage area	Talc	14807-96-6	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Sodium bromate- breaker	50,441	151,323	L	Stimulation chemical storage area	Sodium bromate	7789-38-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Hepta sodium phosphonate- Emulsifier	3,176	9,528	L	Stimulation chemical storage area	Hepta sodium phosphonate	22042-96-2	AECOM, 2024 – Appendix E

Amended EMP text

							Appendix E.1 AECOM, 2024 – Appendix E.2
Ammonium sulphate- breaker	4,479	13,491	L	Stimulation chemical storage area	Ammonium sulphate	7783-20-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Polyacrylamide- friction reducer	4,479	13,491	L	Stimulation chemical storage area	Polyacrylamide	25085-02-3	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Sodium polyacrylate- gelling agent	746	2,238	L	Stimulation chemical storage area	Sodium polyacrylate	9003-04-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Sodium bisulfite- stabiliser	149	447	L	Stimulation chemical storage area	Sodium bisulfite	7631-90-5	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Alkyl alcohol- surfactant	149	447	L	Stimulation chemical storage area	Alkyl alcohol	56-81-5	EHS Support, (2023) – Appendix E.1
2-Propenoic acid, homopolymer, ammonium salt- biocide	149	447	L	Stimulation chemical storage area	2-Propenoic acid, homopolymer, ammonium salt	9003-03-6	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Potassium persulfate- braker	149	447	L	Stimulation chemical storage area	Potassium persulfate	7727-21-1	AECOM, 2024 – Appendix E

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							EHS Support, (2023) – Appendix E.1
Distillates, hydrotreated light- friction reducer	54,231	162,693	L	Stimulation chemical storage area	Distillates, hydrotreated light	64742-47-8	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Guar gum- viscosity regulator	15,141	45,423	L	Stimulation chemical storage area	Guar gum	9000-30-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Poly-oxyethylene nonylphenol ether- surfactant	4,466	13,398	L	Stimulation chemical storage area	Poly-oxyethylene nonylphenol ether	9016-45-9	EHS Support, (2023) – Appendix E.1
Quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with bentonite- biocide	4,466	13,398	L	Stimulation chemical storage area	Quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with bentonite	68953-58-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
1,6-Hexanediol- cross linker	447	1,341	L	Stimulation chemical storage area	1,6-Hexanediol	629-11-8	EHS Support, (2023) – Appendix E.1
Hydrochloric acid- pH control	44,715	134,145	L	Stimulation chemical storage area	Hydrochloric acid	7647-01-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
N-Benzyl-alkylpyridinium chloride- pH control	28	84	L	Stimulation chemical storage area	N-Benzyl-alkylpyridinium chloride	68909-18-2	EHS Support, (2023) – Appendix E.1
Formic acid- corrosion inhibitor	38	114	L	Stimulation chemical storage area	Formic acid	64-18-6	EHS Support, (2023) – Appendix E.1
Sodium erythorbate- scaler prohibitor	334	1,002	L	Stimulation chemical storage area	Sodium erythorbate	6381-77-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Citric acid- pH control	15,878	47,634	L	Stimulation chemical storage area	Citric acid	77-92-9	AECOM, 2024 – Appendix E

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							EHS Support, (2023) – Appendix E.1
2-Ethoxy-naphthalene- surfactant	149	447	L	Stimulation chemical storage area	2-Ethoxy-naphthalene	93-18-5	EHS Support, (2023) – Appendix E.1
Sodium gluconate- stabiliser	8,576	25,728	L	Stimulation chemical storage area	Sodium gluconate	527-07-1	EHS Support, (2023) – Appendix E.1
Boric acid- crosslinker	4,288	12,864	L	Stimulation chemical storage area	Boric acid	10043-35-3	EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Potassium hydroxide- pH control	10,745	32,235	L	Stimulation chemical storage area	Potassium hydroxide	1310-58-3	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Mannanase- crosslinker	2	6	L	Stimulation chemical storage area	Mannanase	37288-54-3	EHS Support, (2023) – Appendix E.1
Ammonium persulphate- breaker Diammonium peroxidisulphate – Oxidizing viscosity breaker	7,451	22,353	L	Stimulation chemical storage area	Ammonium persulphate	7727-54-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Talc- buffer/ Filler for encapsulate	384	1,152	L	Stimulation chemical storage area	Talc, Magnesium Silicate	14807-96-6	AECOM, 2024 – Appendix E EHS Support,

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							EHS Support, (2023) – Appendix E.1
Acetic acid- pH control	15,878	47,634	L	Stimulation chemical storage area	Acetic acid	64-19-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Isopropanol- clay management	83	249	L	Stimulation chemical storage area	Isopropanol	67-63-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Ethoxylated C12-C16 alcohol - surfactant	57	171	L	Stimulation chemical storage area	Ethoxylated C12-C16 alcohol	68551-12-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Ethoxylated decanol - surfactant	19	57	L	Stimulation chemical storage area	Ethoxylated decanol	26183-52-8	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Cinnamaldehyde- biocide	57	171	L	Stimulation chemical storage area	Cinnamaldehyde	104-55-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Ethoxylated tallow alkyl amine - surfactant	9	27	L	Stimulation chemical storage area	Ethoxylated tallow alkyl amine	61791-26-2	EHS Support, (2023) – Appendix E.1
Methanol- corrosion inhibitor	2	6	L	Stimulation chemical storage area	Methanol	67-56-1	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Polyacrylamide - friction reducer	49,093	147,279	L	Stimulation chemical storage area	Polyacrylamide	9003-05-08	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Polyethylene glycol trimethylnonyl ether - clay manager	87	261	L	Stimulation chemical storage area	Polyethylene glycol trimethylnonyl ether	127087-87-0	EHS Support, (2023) – Appendix E.1

Amended EMP text

							(2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Sodium bromate- breaker	50,441	151,323	L	Stimulation chemical storage area	Sodium bromate	7789-38-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Hepta sodium phosphonate- Emulsifier	3,176	9,528	L	Stimulation chemical storage area	Hepta sodium phosphonate	22042-96-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Distillates, hydrotreated light- friction reducer/slurry agent	54,231	162,693	L	Stimulation chemical storage area	Distillates, hydrotreated light	64742-47-8	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Guar gum- viscosity regulator	15,141	45,423	L	Stimulation chemical storage area	Guar gum	9000-30-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Poly-oxyethylene nonylphenol ether- surfactant	4,466	13,398	L	Stimulation chemical storage area	Poly-oxyethylene nonylphenol ether	9016-45-9	EHS Support, (2023) – Appendix E.1
Quaternary ammonium compounds, bis(hydrogenated	4,466	13,398	L	Stimulation chemical storage area	Quaternary ammonium compounds,	68953-58-2	AECOM, 2024 – Appendix E

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Water in additive-stabiliser	66,804	200,412	L	Stimulation chemical storage area	Water in additive	7732-18-5	EHS Support, (2023) – Appendix E.1
Potassium sorbate food grade-corrosion inhibitor	14	42	L	Stimulation chemical storage area	Potassium sorbate	24634-61-5	EHS Support, (2023) – Appendix E.1
Mannanase (Mannan endo-1,4-beta-mannosidase)-cross linker	2	6	L	Stimulation chemical storage area	Mannanase (Mannan endo-1,4-beta-mannosidase)	37288-54-3	EHS Support, (2023) – Appendix E.1
Nonoxynol-9-surfactant	9	27	L	Stimulation chemical storage area	Nonoxynol-9	26571-11-9	EHS Support, (2023) – Appendix E.1
2-Ethylhexanol PO/EO polymer-stabiliser	9	27	L	Stimulation chemical storage area	2-Ethylhexanol PO/EO polymer	64366-70-7	EHS Support, (2023) – Appendix E.1
Corn oil- friction reducer	662	1,986	L	Stimulation chemical storage area	Corn oil	8001-30-7	EHS Support, (2023) – Appendix E.1
Sodium chloride-weighting agent	15,000	45,000	kg	Completion chemical storage area	Sodium chloride	7647-14-5	AECOM, 2024 – Appendix E
ALDACIDE G biocide	500	1,500	L	Completion chemical storage area	Glutaraldehyde Methanol	111-30-8 67-56-1	AECOM, 2024 – Appendix E
OXYGON Oxygen scavenger	100	300	kg	Completion chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BARACOR 100 corrosion inhibitor	2,000	6,000	L	Completion chemical storage area	Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues Methanol Nitrilotriacetic acid, trisodium salt monohydrate	68909-77-3 67-56-1 5064-31-3	AECOM, 2024 – Appendix E
Sodium Hypochlorite 10 – 30% cleaner	10,000	30,000	L	Completion chemical storage area	Sodium hypchlorite Sodium Hydroxide Water	7681-52-9 1310-73-2 7732-18-5	AECOM, 2024 – Appendix E
CON-DET wetting agent	50	150	kg	Drilling chemical storage area	Amides, coco, N,N-bis (hydroxyethyl)	68603-42-9	AECOM, 2024 – Appendix E

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tallow alkyl)dimethyl, salts with bentonite-biocide					bis(hydrogenated tallow alkyl)dimethyl, salts with bentonite		EHS Support, (2023) – Appendix E.1
1,6-Hexanediol- cross linker	447	1,341	L	Stimulation chemical storage area	1,6-Hexanediol	629-11-8	EHS Support, (2023) – Appendix E.1
Hydrochloric acid- pH control	44,715	134,145	L	Stimulation chemical storage area	Hydrochloric acid	7647-01-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
N-Benzyl-alkylpyridinium chloride- pH control	28	84	L	Stimulation chemical storage area	N-Benzyl-alkylpyridinium chloride	68909-18-2	EHS Support, (2023) – Appendix E.1
Formic acid- corrosion inhibitor	2,001	6,002	L	Stimulation chemical storage area	Formic acid	64-18-6	EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Sodium erythorbate-scaler prohibitor/Reducing Agent	2,001	6,002	L	Stimulation chemical storage area	Sodium erythorbate	6381-77-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Citric acid- pH control	15,878	47,634	L	Stimulation chemical storage area	Citric acid	77-92-9	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Acetic acid- pH Buffer	15,878	47,634	L	Stimulation chemical storage area	Acetic acid	64-19-7	AECOM, 2024 – Appendix E

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					Benzenesulfonic acid, dimethyl-, sodium salt Isopropanol Potassium pyrophosphate Potassium hydroxide	1300-72-7 67-63-0 7320-34-5 1310-58-3	
SAPP- sodium acid phosphate cement treatment	50	150	kg	Drilling chemical storage area	DISODIUM PYROPHOSPHATE	7758-16-9	AECOM, 2024 – Appendix E
Bentonite-lubricant	3,000	9,000	kg	Drilling chemical storage area	Crystalline silica, quartz Crystalline silica, cristobalite Crystalline silica, tridymite	14808-60-7 14464-46-1 15468-32-3	AECOM, 2024 – Appendix E
Caustic Soda-pH control	1,400	4,200	kg	Drilling chemical storage area	SODIUM HYDROXIDE	1310-73-2	AECOM, 2024 – Appendix E
EZ MUD DP or EZ MUD Liquid-drilling mud	2000	6,000	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
ALDACIDE G biocide	336	1,008	kg	Drilling chemical storage area	Glutaraldehyde Methanol	111-30-8 67-56-1	AECOM, 2024 – Appendix E
STOPPIT loss of circulation material	1,000	3,000	kg	Drilling chemical storage area	Crystalline silica, quartz	14808-60-7	AECOM, 2024 – Appendix E
Soda Ash- drill mud conditioner	350	1,050	kg	Drilling chemical storage area	SODIUM CARBONATE	497-19-8	AECOM, 2024 – Appendix E
BARACOR 100 corrosion inhibitor	250	750	kg	Drilling chemical storage area	Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues Methanol Nitrilotriacetic acid, trisodium salt monohydrate	68909-77-3 67-56-1 5064-31-3	AECOM, 2024 – Appendix E
Sodium chloride (flossy salt)-weighting agent	96,000	288,000	kg	Drilling chemical storage area	Sodium chloride	7647-14-5	AECOM, 2024 – Appendix E

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							EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Isopropanol- clay management	83	249	L	Stimulation chemical storage area	Isopropanol	67-63-0	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Ethoxylated C12-C16 alcohol - surfactant	57	171	L	Stimulation chemical storage area	Ethoxylated C12-C16 alcohol	68551-12-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Ethoxylated decanol - surfactant	19	57	L	Stimulation chemical storage area	Ethoxylated decanol	26183-52-8	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Cinnamaldehyde-biocide / Corrosion inhibitor	1,000	3,000	L	Stimulation chemical storage area	Cinnamaldehyde	104-55-2	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
Ethoxylated tallow alkyl amine - surfactant	9	27	L	Stimulation chemical storage area	Ethoxylated tallow alkyl amine	61791-26-2	EHS Support, (2023) – Appendix E.1
Methanol- corrosion inhibitor	2	6	L	Stimulation chemical storage area	Methanol	67-56-1	AECOM, 2024 – Appendix E EHS Support,

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and formation inhibitor							
Barite- weighting agent	500	1,500	kg	Drilling chemical storage area	Crystalline silica	14808-60-7	AECOM, 2024 – Appendix E
BARACARB loss of circulation material	500	1,500	kg	Drilling chemical storage area	Crystalline silica, quartz	14808-60-7	AECOM, 2024 – Appendix E
Citric acid- pH control	500	1,500	kg	Drilling chemical storage area	Citric acid	5949-29-1	AECOM, 2024 – Appendix E
BARADEFOAM HP drilling fluid/foam	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
Sodium bicarbonate- pH buffer	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
PERFORMATROL- polymer fluid system	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
SOURSCAV- mud additive treat H2S contamination	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DRIL-N-SLIDE- casing lubricant	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
STEELSEAL- corrosion inhibitor	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations	Proprietary	AECOM, 2024 – Appendix E

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							(2023) – Appendix E.1
Polyacrylamide - friction reducer	49,093	147,279	L	Stimulation chemical storage area	Polyacrylamide	9003-05-08	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 AECOM, 2004 – Appendix E.2
Polyethylene glycol trimethylnonyl ether - clay manager/ Emulsifier	748	2,243	L	Stimulation chemical storage area	Polyethylene glycol trimethylnonyl ether	127087-87-0	EHS Support, (2023) – Appendix E.1 AECOM, 2024 - Appendix E.2
Water in additive- stabiliser	66,804	200,412	L	Stimulation chemical storage area	Water in additive	7732-18-5	EHS Support, (2023) – Appendix E.1
Potassium sorbate food grade- corrosion inhibitor	14	42	L	Stimulation chemical storage area	Potassium sorbate	24634-61-5	EHS Support, (2023) – Appendix E.1
Mannanase (Mannan endo-1,4-beta-mannosidase)- cross linker	2	6	L	Stimulation chemical storage area	Mannanase (Mannan endo-1,4-beta-mannosidase)	37288-54-3	EHS Support, (2023) – Appendix E.1
Nonoxynol-9- surfactant/Emulsifier	51	153	L	Stimulation chemical storage area	Nonoxynol-9	26571-11-9	EHS Support, (2023) – Appendix E.1 AECOM, 2024 – Appendix E.2
2-Ethylhexanol PO/EO polymer- stabiliser	9	27	L	Stimulation chemical storage area	2-Ethylhexanol PO/EO polymer	64366-70-7	EHS Support, (2023) – Appendix E.1

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					above cut-off values according to the competent authority		
BARAZAN D or BARAZAN D PLUS- viscosity increaser	4,150	12,450	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
PAC L loss of circulation material	2,300	6,900	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
Potassium chloride- weighting agent and formation inhibitor	22,500	67,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
QUIK-FREE – drilling additive	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BAROFIBRE, BAROFIBRE super fine and BAROFIBRE coarse loss of circulation material	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BaraBlend-657 Loss of circulation material	500	1,500	kg	Drilling chemical storage area	Crystalline silica, quartz	14808-60-7	AECOM, 2024 – Appendix E
N-DRIL HT PLUS filtration control additive	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E

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Corn oil- friction reducer	662	1,986	L	Stimulation chemical storage area	Corn oil	8001-30-7	EHS Support, (2023) – Appendix E.1
Proprietary – SCI-1F Scale inhibitor	19,357	58,071	L	Stimulation chemical storage area	Based on the CRA, the chemical is of low concern to human health and the environment. Chemicals were PBT and calculated below the risk thresholds.	Proprietary	AECOM, 2024 – Appendix E.2
Proprietary – surface coating	44	131	L	Stimulation chemical storage area	Based on the CRA, the chemical is of low concern to human health and the environment. Chemicals were PBT and calculated below the risk thresholds.	Proprietary	AECOM, 2024 – Appendix E.2
Sodium carbonate – pH buffer	78.5	236	L	Stimulation chemical storage area	Sodium carbonate	497-19-8	AECOM, 2024 – Appendix E.2
Proprietary – improves surface and interfacial tension	292	876	L	Stimulation chemical storage area	Based on the CRA, the chemical is of low concern to human health and the environment. Chemicals were PBT and calculated below the risk thresholds.	Proprietary	AECOM, 2024 – Appendix E.2
Proprietary – surfactant	7,592	22,776	L	Stimulation chemical storage area	Based on the CRA, the chemical is of low concern to human health and the environment. Chemicals were PBT and calculated below the risk thresholds.	Proprietary	AECOM, 2024 – Appendix E.2
Alkyl Pyridines Quat – Corrosion inhibitor	128	384	L	Stimulation chemical storage area	Alkyl Pyridines Quat	68909-18-2	AECOM, 2024 –

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DEXTRID LTE filtration control additive	4,600	13,800	kg	Drilling chemical storage area	Tetrahydro-3,5-dimethyl-1,3,5-thiadiazine-2-thione	533-74-4	AECOM, 2024 – Appendix E
BARABUF pH buffer	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BDF 933 or BaraLube W-933 drilling lubricant	864	2,592	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BAROLIFT sweeping agent	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
OXYGON oxygen scavenger	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
ENVIRO-THIN filtration control additive	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
Lime pH buffer	500	1,500	kg	Drilling chemical storage area	Calcium hydroxide	1305-62-0	AECOM, 2024 – Appendix E
Calcium chloride	37,000	111,000	kg	Drilling chemical storage area	Calcium chloride	10043-52-4	AECOM, 2024 – Appendix E

Amended EMP text

							Appendix E.2
Polymer/s - Isotridecanol, ethoxylated – Emulsifier	5,742	17,225	L	Stimulation chemical storage area	Isotridecanol, ethoxylated	69011-36-5	AECOM, 2024 – Appendix E.2
HCL-15B – Hydrochloric acid Blend – mineral acid	76,201	228,603	L	Stimulation chemical storage area	Hydrochloric acid	7647-01-0	AECOM, 2024 – Appendix E.2
Proprietary - Emulsifier	8,614	25,842	L	Stimulation chemical storage area	Based on the CRA, the chemical is of low concern to human health and the environment. Chemicals were PBT and calculated below the risk thresholds.	Proprietary	AECOM, 2024 – Appendix E.2
Didecyldimethyl-ammonium Chloride - Biocide	1,936	5,807	L	Stimulation chemical storage area	Didecyldimethyl-ammonium Chloride	7173-51-5	AECOM, 2024 – Appendix E.2
Benzalkonium Chloride – Biocide	1,936	5,807	L	Stimulation chemical storage area	Benzalkonium Chloride	8001-54-5	AECOM, 2024 – Appendix E.2
Proprietary – Improve surface and interfacial tension	1,022	3,066	L	Stimulation chemical storage area	Based on the CRA, the chemical is of low concern to human health and the environment. Chemicals were PBT and calculated below the risk thresholds.	Proprietary	AECOM, 2024 – Appendix E.2
Proprietary – Improve surface and interfacial tension	341	1,022	L	Stimulation chemical storage area	Based on the CRA, the chemical is of low concern to human health and the environment. Chemicals were PBT and calculated below the risk thresholds.	Proprietary	AECOM, 2024 – Appendix E.2
Completion chemicals							
Sodium chloride-weighting agent	15,000	45,000	kg	Completion chemical storage area	Sodium chloride	7647-14-5	AECOM, 2024 – Appendix E

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Sodium bromide	8,160	24,480	kg	Drilling chemical storage area	Sodium bromide	7647-15-6	AECOM, 2024 – Appendix E
Evolube TR	14,500	43,500	L	Drilling chemical storage area	Triethylene glycol, monobutyl ether 2-Butoxyethanol Diethanolamine	143-22-6 111-76-2 111-42-2	AECOM, 2024 – Appendix E
Radiagreen EME	4,800	14,400	L	Drilling chemical storage area	Fatty esters Specialities	Proprietary	AECOM, 2024 – Appendix E
Radiagreen EBL	4,800	14,400	L	Drilling chemical storage area	Fatty esters Specialities	Proprietary	AECOM, 2024 – Appendix E
Polydrill	7,500	22,500	kg	Drilling chemical storage area	SULPHONATED ORGANIC POLYMER	Proprietary	AECOM, 2024 – Appendix E
Alpine spotting beads	1,000	3,000	kg	Drilling chemical storage area	Styrene	100-42-5	AECOM, 2024 – Appendix E
Barite- weighting agent	354,000	1,062,000	kg	Drilling chemical storage area	Barium sulfate Crystalline silica Mica-group minerals	7727-43-7 14808-60-7 12001-26-2	AECOM, 2024 – Appendix E
Bio-Paq HT filtration control	1,134	3,402	kg	Drilling chemical storage area	Starch, carboxymethyl ether, sodium salt	9063-38-1	AECOM, 2024 – Appendix E
Brine-Pac XTS corrosion inhibitor	3,400	10,200	L	Drilling chemical storage area	2-methylbut-3-yn-2-ol	115-19-5	AECOM, 2024 – Appendix E
Calcium chloride - salinity	180,000	540,000	kg	Drilling chemical storage area	calcium chloride	10043-52-4	AECOM, 2024 – Appendix E
CF Desco deflocculant	2,270	6,810	kg	Drilling chemical storage area	Tannins, sulfo-methylated crystalline silica, respirable powder	68201-64-9 14808-60-7	AECOM, 2024 – Appendix E
Chek-Loss fibrous LCM	1,360	4,080	kg	Drilling chemical storage area	Cellulose	9004-34-6	AECOM, 2024 – Appendix E
Citric acid pH control	1,361	4,083	L	Drilling chemical storage area	Citric acid	77-92-9	AECOM, 2024 – Appendix E
Ecco-Temp HT extender	8,000	24,000	L	Drilling chemical storage area	Triethanolamine	102-71-6	AECOM, 2024 – Appendix E
Flowzan viscosifier	5,000	15,000	kg	Drilling chemical storage area	Contains no hazardous	N/A	AECOM, 2024 – Appendix E

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ALDACIDE G biocide	500	1,500	L	Completion chemical storage area	Glutaraldehyde Methanol	111-30-8 67-56-1	AECOM, 2024 – Appendix E
OXYGON Oxygen scavenger	100	300	kg	Completion chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BARACOR 100 corrosion inhibitor	2,000	6,000	L	Completion chemical storage area	Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues Methanol Nitrilotriacetic acid, trisodium salt monohydrate	68909-77-3 67-56-1 5064-31-3	AECOM, 2024 – Appendix E
Sodium Hypochlorite 10 – 30% cleaner	10,000	30,000	L	Completion chemical storage area	Sodium hypochlorite Sodium Hydroxide Water	7681-52-9 1310-73-2 7732-18-5	AECOM, 2024 – Appendix E
Drilling chemicals							
CON-DET wetting agent	50	150	kg	Drilling chemical storage area	Amides, coco, N,N-bis (hydroxyethyl) Benzenesulfonic acid, dimethyl-, sodium salt Isopropanol Potassium pyrophosphate Potassium hydroxide	68603-42-9 1300-72-7 67-63-0 7320-34-5 1310-58-3	AECOM, 2024 – Appendix E
SAPP- sodium acid phosphate cement treatment	50	150	kg	Drilling chemical storage area	DISODIUM PYROPHOSPHATE	7758-16-9	AECOM, 2024 – Appendix E
Bentonite- lubricant	3,000	9,000	kg	Drilling chemical storage area	Crystalline silica, quartz Crystalline silica, cristobalite Crystalline silica, tridymite	14808-60-7 14464-46-1 15468-32-3	AECOM, 2024 – Appendix E
Caustic Soda-pH control	1,400	4,200	kg	Drilling chemical storage area	Sodium hydroxide	1310-73-2	AECOM, 2024 – Appendix E

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					ingredients according to GHS.		
Mil-Lime - alkalinity	1,361	4,083	L	Drilling chemical storage area	calcium di-hydroxide	1305-62-0	AECOM, 2024 – Appendix E
Magnesium oxide pH buffer	7,500	22,500	kg	Drilling chemical storage area	magnesium oxide	1309-48-4	AECOM, 2024 – Appendix E
Mil-bio SEA 98 biocide	1,800	5,400	L	Drilling chemical storage area	THPS	55566-30-8	AECOM, 2024 – Appendix E
Mil-carb LCM / bridging	5,000	15,000	kg	Drilling chemical storage area	Limestone crystalline silica, respirable powder	1317-65-3 14808-60-7	AECOM, 2024 – Appendix E
Milstarch filtration control	5,000	15,000	kg	Drilling chemical storage area	Starch	9005-25-8	AECOM, 2024 – Appendix E
Navi-Lube lubricant	16,650	49,950	L	Drilling chemical storage area	Distillates, (petroleum), hydrotreated light Diethylene glycol monobutyl ether Benzene, mono-C10-13-alkyl derivatives, fractionation bottoms, heavy ends, sulfonated, sodium salts Petroleum distillates, hydrotreated heavy naphthenic Benzenesulfonic acid, C10-14-alkyl derivatives, sodium salts	64742-47-8 112-34-5 148520-82-5 64742-52-5 69669-44-9	AECOM, 2024 – Appendix E
New-Drill Plus shale stabiliser	1,000	3,000	kg	Drilling chemical storage area	2-Propenoic acid, polymer with 2-propenamide, sodium salt	25987-30-8	AECOM, 2024 – Appendix E
Noxygen XT oxygen scavenger	884	2,652	kg	Drilling chemical storage area	2,3-didehydro-3-O-sodio-D-erythro-hexono-1,4-lactone	6381-77-7	AECOM, 2024 – Appendix E
Ova Col 110 HC cloud point glycol	13,000	39,000	kg	Drilling chemical storage area	Glycol Ether	9004-77-7	AECOM, 2024 – Appendix E

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EZ MUD DP or EZ MUD Liquid- drilling mud	2000	6,000	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
ALDACIDE G biocide	336	1,008	kg	Drilling chemical storage area	Glutaraldehyde Methanol	111-30-8 67-56-1	AECOM, 2024 – Appendix E
STOPPIT loss of circulation material	1,000	3,000	kg	Drilling chemical storage area	Crystalline silica, quartz	14808-60-7	AECOM, 2024 – Appendix E
Soda Ash- drill mud conditioner	350	1,050	kg	Drilling chemical storage area	Sodium carbonate	497-19-8	AECOM, 2024 – Appendix E
BARACOR 100 corrosion inhibitor	250	750	kg	Drilling chemical storage area	Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivatives residues Methanol Nitrilotriacetic acid, trisodium salt monohydrate	68909-77-3 67-56-1 5064-31-3	AECOM, 2024 – Appendix E
Sodium chloride (flossy salt)- weighting agent and formation inhibitor	96,000	288,000	kg	Drilling chemical storage area	Sodium chloride	7647-14-5	AECOM, 2024 – Appendix E
Barite- weighting agent	500	1,500	kg	Drilling chemical storage area	Crystalline silica	14808-60-7	AECOM, 2024 – Appendix E
BARACARB loss of circulation material	500	1,500	kg	Drilling chemical storage area	Crystalline silica, quartz	14808-60-7	AECOM, 2024 – Appendix E
Citric acid- pH control	500	1,500	kg	Drilling chemical storage area	Citric acid	5949-29-1	AECOM, 2024 – Appendix E
BARADEFOAM HP drilling fluid/foam	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
Sodium bicarbonate- pH buffer	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according	Proprietary	AECOM, 2024 – Appendix E

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Potassium chloride salt / shale stabiliser	41,000	123,000	kg	Drilling chemical storage area	potassium chloride	7447-40-7	AECOM, 2024 – Appendix E
Potassium hydroxide pH source	1,250	3,750	kg	Drilling chemical storage area	potassium hydroxide	1310-58-3	AECOM, 2024 – Appendix E
Pyro-Trol II HT filtration control	25	75	kg	Drilling chemical storage area	Copolymer of acrylamide and 2-acrylamide-2-2methyl propane sulfonic acid	Proprietary	AECOM, 2024 – Appendix E
Pyro-Vis II HT viscosifier	1,400	4,200	kg	Drilling chemical storage area	t-Butyl alcohol	75-65-0	AECOM, 2024 – Appendix E
Soda ash pH and hardness control	1,000	3,000	kg	Drilling chemical storage area	sodium carbonate	497-19-8	AECOM, 2024 – Appendix E
Sodium bicarbonate pH and hardness control	1,000	3,000	kg	Drilling chemical storage area	sodium hydrogen carbonate	144-55-8	AECOM, 2024 – Appendix E
Sodium chloride salt	54,400	163,200	kg	Drilling chemical storage area	sodium chloride	7647-14-5	AECOM, 2024 – Appendix E
W.O. defoam defoamer	600	1,800	L	Drilling chemical storage area	1-Hexanol, 2-ethyl-	104-76-7	AECOM, 2024 – Appendix E
Xan-Plex D viscosifier	3,000	9,000	kg	Drilling chemical storage area	Contains no hazardous ingredients according to GHS.	N/A	AECOM, 2024 – Appendix E
TEQ-LUBE II - lubricant	14,400	43,200	kg	Drilling chemical storage area	Poly(oxy-1,2-ethanediyl),α-hydro-ω-hydroxy-Ethane-1,2-diol, ethoxylated	25322-68-3	AECOM, 2024 – Appendix E
TEQ-LUBE II - lubricant	14,400	43,200	kg	Drilling chemical storage area	Poly(oxy-1,2-ethanediyl), α-(9Z)-9-octadecen-1-yl-ω-hydroxy-, phosphate	39464-69-2	AECOM, 2024 – Appendix E
NEW-THIN – Polymeric thinner	4,680	14,040	kg	Drilling chemical storage area	Contains no hazardous ingredients according to GHS.	N/A	AECOM, 2024 – Appendix E
LC-LUBE -lubricant (graphite)	9,090	27,270	kg	Drilling chemical storage area	Natural graphite	7782-42-5	AECOM, 2024 – Appendix E
Diesel	250	750	KL	Diesel storage tanks – CAS numbers and storage and as per safety data sheet			
Hydraulic oil	1,000	3,000	L	Workshop – CAS numbers and storage as per safety data sheet			

Amended EMP text

					to the competent authority		
PERFORMATROL- polymer fluid system	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
SOURSCAV- mud additive treat H2S contamination	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DRIL-N-SLIDE- casing lubricant	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
STEELSEAL- corrosion inhibitor	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BARAZAN D or BARAZAN D PLUS- viscosity increaser	4,150	12,450	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
PAC L loss of circulation material	2,300	6,900	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
Potassium chloride- weighting agent and formation inhibitor	22,500	67,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according	Proprietary	AECOM, 2024 – Appendix E

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Engine oil	1,000	3,000	L	Workshop – CAS numbers and storage and as per safety data sheet			
Degreasers	100	300	L	Workshop – CAS numbers and storage and as per safety data sheet			
Waste drilling fluids	2,500	7,500	m^3	Drilling mud sump – as per Code			
Completion fluids	1.4	4.2	ML	Drilling mud sump/on-site tank – as per Code			
Condensate	10	10	KL	Self-bunded waste oil pods – as per Code			
Flowback	~10.8 ML per well		ML	Flowback tanks. Assessed by AECOM, 2024 – Appendix E			
Proppants*							
100 mesh sand-proppant	91,000	273,000	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Quartz or organophilic phyllosilicate-proppant	1,084	3,252	L	Stimulation chemical storage area	Quartz or organophilic phyllosilicate	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
40/70 sand-proppant	1,650,000	4,950,000	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
30/50 sand-proppant	610,000	1,830,000	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 as 20/40

* Proppants are sand which is inert. They do not require special chemical bunding but are co-located in the stimulation chemical storage area, within the well pad bund. Residual proppant from a stimulation campaign is often used to assist with chemical spills on the well pad, where contaminated spill material is removed.

Amended EMP text

					to the competent authority		
QUIK-FREE – drilling additive	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BAROFIBRE, BAROFIBRE super fine and BAROFIBRE coarse loss of circulation material	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BaraBlend-657 Loss of circulation material	500	1,500	kg	Drilling chemical storage area	Crystalline silica, quartz	14808-60-7	AECOM, 2024 – Appendix E
N-DRIL HT PLUS filtration control additive	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
DEXTRID LTE filtration control additive	4,600	13,800	kg	Drilling chemical storage area	Tetrahydro-3,5-dimethyl-1,3,5-thiadiazine-2-thione	533-74-4	AECOM, 2024 – Appendix E
BARABUF pH buffer	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BDF 933 or BaraLube W-933 drilling lubricant	864	2,592	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
BAROLIFT sweeping agent	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off	Proprietary	AECOM, 2024 – Appendix E

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					values according to the competent authority		
OXYGON oxygen scavenger	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
ENVIRO-THIN filtration control additive	500	1,500	kg	Drilling chemical storage area	Contains no hazardous substances in concentrations above cut-off values according to the competent authority	Proprietary	AECOM, 2024 – Appendix E
Lime pH buffer	500	1,500	kg	Drilling chemical storage area	Calcium hydroxide	1305-62-0	AECOM, 2024 – Appendix E
Calcium chloride	37,000	111,000	kg	Drilling chemical storage area	Calcium chloride	10043-52-4	AECOM, 2024 – Appendix E
Sodium bromide	8,160	24,480	kg	Drilling chemical storage area	Sodium bromide	7647-15-6	AECOM, 2024 – Appendix E
Evolube TR	14,500	43,500	L	Drilling chemical storage area	Triethylene glycol, monobutyl ether 2-Butoxyethanol Diethanolamine	143-22-6 111-76-2 111-42-2	AECOM, 2024 – Appendix E
Radiagreen EME	4,800	14,400	L	Drilling chemical storage area	Fatty esters Specialities	Proprietary	AECOM, 2024 – Appendix E
Radiagreen EBL	4,800	14,400	L	Drilling chemical storage area	Fatty esters Specialities	Proprietary	AECOM, 2024 – Appendix E
Polydrill	7,500	22,500	kg	Drilling chemical storage area	SULPHONATED ORGANIC POLYMER	Proprietary	AECOM, 2024 – Appendix E
Alpine spotting beads	1,000	3,000	kg	Drilling chemical storage area	Styrene	100-42-5	AECOM, 2024 – Appendix E
Barite- weighting agent	354,000	1,062,000	kg	Drilling chemical storage area	Barium sulfate Crystalline silica Mica-group minerals	7727-43-7 14808-60-7 12001-26-2	AECOM, 2024 – Appendix E

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Bio-Paq high temp filtration control	1,134	3,402	kg	Drilling chemical storage area	Starch, carboxymethyl ether, sodium salt	9063-38-1	AECOM, 2024 – Appendix E
Brine-Pac XTS corrosion inhibitor	3,400	10,200	L	Drilling chemical storage area	2-methylbut-3-yn-2-ol	115-19-5	AECOM, 2024 – Appendix E
Calcium chloride - salinity	180,000	540,000	kg	Drilling chemical storage area	calcium chloride	10043-52-4	AECOM, 2024 – Appendix E
CF Desco deflocculant	2,270	6,810	kg	Drilling chemical storage area	Tannins, sulfo-methylated crystalline silica, respirable powder	68201-64-9 14808-60-7	AECOM, 2024 – Appendix E
Chek-Loss fibrous LCM	1,360	4,080	kg	Drilling chemical storage area	Cellulose	9004-34-6	AECOM, 2024 – Appendix E
Citric acid - pH control	1,360	4,080	L	Drilling chemical storage area	Citric acid	77-92-9	AECOM, 2024 – Appendix E
Ecco-Temp high temp extender	8,000	24,000	L	Drilling chemical storage area	Triethanolamine	102-71-6	AECOM, 2024 – Appendix E
Flowzan viscosifier	5,000	15,000	kg	Drilling chemical storage area	Contains no hazardous ingredients according to GHS.	N/A	AECOM, 2024 – Appendix E
Mil-Lime (Calcium hydroxide) alkalinity	1,361	4,080	L	Drilling chemical storage area	calcium di-hydroxide	1305-62-0	AECOM, 2024 – Appendix E
Magnesium oxide pH buffer	7,500	22,500	kg	Drilling chemical storage area	magnesium oxide	1309-48-4	AECOM, 2024 – Appendix E
Mil-bio SEA 98 biocide	1,800	5,400	L	Drilling chemical storage area	THPS	55566-30-8	AECOM, 2024 – Appendix E
Mil-carb LCM / bridging	5,000	15,000	kg	Drilling chemical storage area	Limestone crystalline silica, respirable powder	1317-65-3 14808-60-7	AECOM, 2024 – Appendix E
Milstarch filtration control	5,000	15,000	kg	Drilling chemical storage area	Starch	9005-25-8	AECOM, 2024 – Appendix E
Navi-Lube lubricant	16,650	49,950	L	Drilling chemical storage area	Distillates, (petroleum), hydrotreated light Diethylene glycol monobutyl ether	64742-47-8 112-34-5	AECOM, 2024 – Appendix E

Interest holder	Tamboran B2 Pty Ltd	EMP Title	Beetaloo Sub-basin Shenandoah South E&A Program EMP	Unique EMP ID	TAM1-3	Mod #	4	Date	16 September 2024

Current EMP text	Amended EMP text

					Benzene, mono-C10-13-alkyl derivatives, fractionation bottoms, heavy ends, sulfonated, sodium salts Petroleum distillates, hydrotreated heavy naphthenic Benzenesulfonic acid, C10-14-alkyl derivatives, sodium salts	148520-82-5 64742-52-5 69669-44-9	
New-Drill Plus shale stabiliser	1,000	3,000	kg	Drilling chemical storage area	2-Propenoic acid, polymer with 2-propenamide, sodium salt	25987-30-8	AECOM, 2024 – Appendix E
Noxygen XT oxygen scavenger	884	2,652	kg	Drilling chemical storage area	2,3-didehydro-3-O-sodio-D-erythro-hexono-1,4-lactone	6381-77-7	AECOM, 2024 – Appendix E
Ova Col 110 HC cloud point glycol	13,000	39,000	kg	Drilling chemical storage area	Glycol Ether	9004-77-7	AECOM, 2024 – Appendix E
Potassium chloride salt / shale stabiliser	41,000	123,000	kg	Drilling chemical storage area	potassium chloride	7447-40-7	AECOM, 2024 – Appendix E
Potassium hydroxide pH source	1,250	3,750	kg	Drilling chemical storage area	potassium hydroxide	1310-58-3	AECOM, 2024 – Appendix E
Pyro-Trol II HT filtration control	25	75	kg	Drilling chemical storage area	Copolymer of acrylamide and 2-acrylamide-2-2methyl propane sulfonic acid	Proprietary	AECOM, 2024 – Appendix E
Pyro-Vis II HT viscosifier	1,400	4,200	kg	Drilling chemical storage area	t-Butyl alcohol	75-65-0	AECOM, 2024 – Appendix E
Soda ash pH and hardness control	1,000	3,000	kg	Drilling chemical storage area	sodium carbonate	497-19-8	AECOM, 2024 – Appendix E
Sodium bicarbonate pH and hardness control	1,000	3,000	kg	Drilling chemical storage area	sodium hydrogen carbonate	144-55-8	AECOM, 2024 – Appendix E
Sodium chloride - salt	54,400	163,200	kg	Drilling chemical storage area	sodium chloride	7647-14-5	AECOM, 2024 – Appendix E

Interest holder	Tamboran B2 Pty Ltd	EMP Title	Beetaloo Sub-basin Shenandoah South E&A Program EMP	Unique EMP ID	TAM1-3	Mod #	4	Date	16 September 2024

Current EMP text	Amended EMP text

W.O. defoam defoamer	600	1,800	L	Drilling chemical storage area	1-Hexanol, 2-ethyl-	104-76-7	AECOM, 2024 – Appendix E
Xan-Plex D viscosifier	3,000	9,000	kg	Drilling chemical storage area	Contains no hazardous ingredients according to GHS.	N/A	AECOM, 2024 – Appendix E
TEQ-LUBE II - lubricant	14,400	43,200	kg	Drilling chemical storage area	Poly(oxy-1,2-ethanediyl),α-hydro-ω-hydroxy-Ethane-1,2-diol, ethoxylated	25322-68-3	AECOM, 2024 – Appendix E
TEQ-LUBE II - lubricant	14,400	43,200	kg	Drilling chemical storage area	Poly(oxy-1,2-ethanediyl), α-(9Z)-9-octadecen-1-yl-ω-hydroxy-, phosphate	39464-69-2	AECOM, 2024 – Appendix E
NEW-THIN – Polymeric thinner	4,680	14,040	kg	Drilling chemical storage area	Contains no hazardous ingredients according to GHS.	N/A	AECOM, 2024 – Appendix E
LC-LUBE -lubricant (graphite)	9,090	27,270	kg	Drilling chemical storage area	Natural graphite	7782-42-5	AECOM, 2024 – Appendix E
Proppants*							
100 mesh sand- proppant	91,000	273,000	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
Quartz or organophilic phyllosilicate- proppant	1,084	3,252	L	Stimulation chemical storage area	Quartz or organophilic phyllosilicate	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1
40/70 sand- proppant	,650,000	4,950,000	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1

Interest holder	Tamboran B2 Pty Ltd	EMP Title	Beetaloo Sub-basin Shenandoah South E&A Program EMP	Unique EMP ID	TAM1-3	Mod #	4	Date	16 September 2024

Current EMP text

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30/50 sand- proppant	610,000	1,830,000	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E EHS Support, (2023) – Appendix E.1 as 20/40
Silicon dioxide (quartz/sand) 100 sand	4,757,614	14,272,842	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E.2
Silicon dioxide (quartz/sand) 40/70	5,435,287	16,305,860	kg	Stimulation chemical storage area	Sand	14808-60-7	AECOM, 2024 – Appendix E.2
* Proppants are sand which is inert. They do not require special chemical bunding but are co-located in the stimulation chemical storage area, within the well pad bund. Residual proppant from a stimulation campaign is often used to assist with chemical spills on the well pad, where contaminated spill material is removed.							
Cleaning Chemicals and Spill Response							
Soda ash – sodium carbonate	3,750	11,250	kg	Stimulation chemical storage area	Sodium carbonate - spill response in event acid spill	497-19-8	AECOM, 2024 – Appendix E.2
Flush fluid - distillates (petroleum), hydrotreated	1,500	4,500	L	Stimulation chemical storage area	Distillates (petroleum), hydrotreated - equipment cleaning	64742-47-8	AECOM, 2024 – Appendix E.2

Appendices

Appendix F Spill Management Plan

Appendix A Chemical volumes per well and storage areas (based on maximum 3 wells per pad)

NOTE: In accordance with the Code, a chemical risk assessment has been completed on all listed chemicals, which have been verified to not be toxic and persistent and bioaccumulative.

Material name	Typical volume	Maximum volume	Unit	Storage area	Hazardous (Y/N)
Acetic acid – 60%	3,000	9,000	L	Stimulation chemical storage area	No
BE-9 Biocide	17,000	51,000	L	Stimulation chemical storage area	Yes
Caustic Soda Liquid	15,000	45,000	L	Stimulation chemical storage area	No
DCA-11001 Breaker activator	5,000	15,000	L	Stimulation chemical storage area	Yes
DCA-13002 Breaker	300	900	kg	Stimulation chemical storage area	Yes
DCA-13003 Breaker	10,000	30,000	L	Stimulation chemical storage area	Yes
DCA-16001 Clay Stabiliser	42,000	126,000	L	Stimulation chemical storage area	No
DCA-17001 Corrosion inhibiter	1,000	3,000	L	Stimulation chemical storage area	Yes
DCA-19001 Crosslinker	600	1,800	kg	Stimulation chemical storage area	Yes

Appendix F Spill Management Plan

Appendix A Chemical volumes per well and storage areas (based on maximum 3 wells per pad)

NOTE: In accordance with the Code, a chemical risk assessment has been completed on all listed chemicals, which have been verified to not be toxic and persistent and bioaccumulative.

Material name	Typical volume	Maximum volume	Unit	Storage area	Hazardous (Y/N)
Acetic acid – 60%	3,000	9,000	L	Stimulation chemical storage area	No
BE-9 Biocide	17,000	51,000	L	Stimulation chemical storage area	Yes
Caustic Soda Liquid	15,000	45,000	L	Stimulation chemical storage area	No
DCA-11001 Breaker activator	5,000	15,000	L	Stimulation chemical storage area	Yes
DCA-13002 Breaker	300	900	kg	Stimulation chemical storage area	Yes
DCA-13003 Breaker	10,000	30,000	L	Stimulation chemical storage area	Yes
DCA-16001 Clay Stabiliser	42,000	126,000	L	Stimulation chemical storage area	No
DCA-17001 Corrosion inhibiter	1,000	3,000	L	Stimulation chemical storage area	Yes
DCA-19001 Crosslinker	600	1,800	kg	Stimulation chemical storage area	Yes

Interest holder	Tamboran B2 Pty Ltd	EMP Title	Beetaloo Sub-basin Shenandoah South E&A Program EMP	Unique EMP ID	TAM1-3	Mod #	4	Date	16 September 2024

Current EMP text						Amended EMP text					
DCA-19002 Crosslinker	10,000	30,000	L	Stimulation chemical storage area	Yes	DCA-19002 Crosslinker	10,000	30,000	L	Stimulation chemical storage area	Yes
DCA-23001 Friction reducer	5,000	15,000	kg	Stimulation chemical storage area	No	DCA-23001 Friction reducer	5,000	15,000	kg	Stimulation chemical storage area	No
DCA-23003 Friction reducer	18,000	54,000	L	Stimulation chemical storage area	No	DCA-23003 Friction reducer	18,000	54,000	L	Stimulation chemical storage area	No
DCA-25005 Gelling agent	35,000	105,000	kg	Stimulation chemical storage area	No	DCA-25005 Gelling agent	35,000	105,000	kg	Stimulation chemical storage area	No
DCA-30001 Scale inhibitor	15,000	45,000	L	Stimulation chemical storage area	No	DCA-30001 Scale inhibitor	15,000	45,000	L	Stimulation chemical storage area	No
DCA-32002 Surfactant	15,000	45,000	L	Stimulation chemical storage area	Yes	DCA-32002 Surfactant	15,000	45,000	L	Stimulation chemical storage area	Yes
DCA-32014 Surfactant	200	600	L	Stimulation chemical storage area	Yes	DCA-32014 Surfactant	200	600	L	Stimulation chemical storage area	Yes
FE-2 Buffer	200	600	kg	Stimulation chemical storage area	No	FE-2 Buffer	200	600	kg	Stimulation chemical storage area	No
Hydrochloric acid – 32%	50,000	150,000	L	Stimulation chemical storage area	Yes	Hydrochloric acid – 32%	50,000	150,000	L	Stimulation chemical storage area	Yes
Alcohols, C11-14-iso-, C13-rich,ethoxylated- Surfactant	5,285	15,855	L	Stimulation chemical storage area	Yes	Alcohols, C11-14-iso-, C13-rich,ethoxylated- Surfactant	5,285	15,855	L	Stimulation chemical storage area	Yes
Sodium (C14-16) olefin sulfonate - Surfactant	4,658	13,974	L	Stimulation chemical storage area	Yes	Sodium (C14-16) olefin sulfonate - Surfactant	4,658	13,974	L	Stimulation chemical storage area	Yes
Diisobutyl glutarate - plasticiser	627	1,881	L	Stimulation chemical storage area	No	Diisobutyl glutarate - plasticiser	627	1,881	L	Stimulation chemical storage area	No
Diisobutyl succinate - plasticiser	209	627	L	Stimulation chemical storage area	No	Diisobutyl succinate - plasticiser	209	627	L	Stimulation chemical storage area	No
Diisobutyl adipate- plasticiser	179	537	L	Stimulation chemical storage area	No	Diisobutyl adipate- plasticiser	179	537	L	Stimulation chemical storage area	No
Sodium thiosulphate- stabilising agent	4,763	14,289	L	Stimulation chemical storage area	No	Sodium thiosulphate- stabilising agent	4,763	14,289	L	Stimulation chemical storage area	No
Sodium sulphate stabilising agent	913	2,739	L	Stimulation chemical storage area	No	Sodium sulphate stabilising agent	913	2,739	L	Stimulation chemical storage area	No
Sodium sulphite stabilising agent	794	2,382	L	Stimulation chemical storage area	No	Sodium sulphite stabilising agent	794	2,382	L	Stimulation chemical storage area	No
Ethylene glycol- crosslinker	5,112	15,336	L	Stimulation chemical storage area	Yes	Ethylene glycol- crosslinker	5,112	15,336	L	Stimulation chemical storage area	Yes
Choline Chloride- Clay stabiliser	10,301	30,903	L	Stimulation chemical storage area	No	Choline Chloride- Clay stabiliser	10,301	30,903	L	Stimulation chemical storage area	No
Glutaraldehyde- biocide	14,930	44,790	L	Stimulation chemical storage area	Yes	Glutaraldehyde- biocide	14,930	44,790	L	Stimulation chemical storage area	Yes
Ammonium sulphate- breaker	4,479	13,491	L	Stimulation chemical storage area	Yes	Ammonium sulphate- breaker	4,479	13,491	L	Stimulation chemical storage area	Yes
Polyacrylamide- friction reducer	4,479	13,491	L	Stimulation chemical storage area	No	Polyacrylamide- friction reducer	4,479	13,491	L	Stimulation chemical storage area	No
Sodium polyacrylate- gelling agent	746	2,238	L	Stimulation chemical storage area	No	Sodium polyacrylate- gelling agent	746	2,238	L	Stimulation chemical storage area	No
Sodium bisulfite- stabiliser	149	447	L	Stimulation chemical storage area	No	Sodium bisulfite- stabiliser	149	447	L	Stimulation chemical storage area	No
Alkyl alcohol- surfactant	149	447	L	Stimulation chemical storage area	Yes	Alkyl alcohol- surfactant	149	447	L	Stimulation chemical storage area	Yes
2-Propenoic acid, homopolymer, ammonium salt- biocide	149	447	L	Stimulation chemical storage area	Yes	2-Propenoic acid, homopolymer, ammonium salt- biocide	149	447	L	Stimulation chemical storage area	Yes
Potassium persulfate-breaker	149	447	L	Stimulation chemical storage area	Yes	Potassium persulfate-breaker	149	447	L	Stimulation chemical storage area	Yes
2-Ethoxy-naphthalene-surfactant	149	447	L	Stimulation chemical storage area	Yes	2-Ethoxy-naphthalene-surfactant	149	447	L	Stimulation chemical storage area	Yes
Sodium gluconate- stabiliser	8,576	25,728	L	Stimulation chemical storage area	No	Sodium gluconate- stabiliser	8,576	25,728	L	Stimulation chemical storage area	No
Boric -crosslinker	4,288	12,864	L	Stimulation chemical storage area	Yes	Boric -crosslinker	4,288	12,864	L	Stimulation chemical storage area	Yes
Potassium hydroxide- pH control	10,745	32,235	L	Stimulation chemical storage area	Yes	Potassium hydroxide- pH control	10,745	32,235	L	Stimulation chemical storage area	Yes
Mannanase- crosslinker	2	6	L	Stimulation chemical storage area	Yes	Mannanase- crosslinker	2	6	L	Stimulation chemical storage area	Yes
Ammonium persulphate- breaker	7,451	22,353	L	Stimulation chemical storage area	Yes	Ammonium persulphate- breaker	7,451	22,353	L	Stimulation chemical storage area	Yes
Talc- buffer	384	1,152	L	Stimulation chemical storage area	No	Talc- buffer	384	1,152	L	Stimulation chemical storage area	No

Interest holder	Tamboran B2 Pty Ltd	EMP Title	Beetaloo Sub-basin Shenandoah South E&A Program EMP	Unique EMP ID	TAM1-3	Mod #	4	Date	16 September 2024

Current EMP text					
Sodium bromate- breaker	50,441	151,323	L	Stimulation chemical storage area	Yes
Hepta sodium phosphonate- emulsifier	3,176	9,528	L	Stimulation chemical storage area	No
Distillates, hydrotreated light- friction reducer	54,231	162,693	L	Stimulation chemical storage area	No
Guar gum- viscosity regulator	15,141	45,423	L	Stimulation chemical storage area	No
Poly-oxyethylene nonylphenol ether- surfactant	4,466	13,398	L	Stimulation chemical storage area	Yes
Quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with bentonite- biocide	4,466	13,398	L	Stimulation chemical storage area	Yes
1,6-Hexanediol- cross linker	447	1,341	L	Stimulation chemical storage area	Yes
Hydrochloric acid- pH control	44,715	134,145	L	Stimulation chemical storage area	Yes
N-benzyl-alkyl pyridinium chloride- pH control	28	84	L	Stimulation chemical storage area	Yes
Formic acid- corrosion inhibitor	38	114	L	Stimulation chemical storage area	Yes
Sodium erythorbate- scaler prohibitor	334	1,002	L	Stimulation chemical storage area	No
Citric acid- pH control	15,878	47,634	L	Stimulation chemical storage area	No
Acetic acid- pH control	15,878	47,634	L	Stimulation chemical storage area	No
Isopropanol- clay management	83	249	L	Stimulation chemical storage area	Yes
Ethoxylated C12-C16 alcohol - surfactant	57	171	L	Stimulation chemical storage area	Yes
Ethoxylated decanol - surfactant	19	57	L	Stimulation chemical storage area	Yes
Cinnamaldehyde- biocide	57	171	L	Stimulation chemical storage area	Yes
Ethoxylated tallow alkyl amine - surfactant	9	27	L	Stimulation chemical storage area	Yes
Methanol- corrosion inhibitor	2	6	L	Stimulation chemical storage area	Yes
Polyacrylamide - friction reducer	49,093	147,279	L	Stimulation chemical storage area	No
Polyethylene glycol trimethylnonyl ether - clay manager	87	261	L	Stimulation chemical storage area	Yes
Water in additive- stabiliser	66,804	200,412	L	Stimulation chemical storage area	No
Potassium sorbate food grade- corrosion inhibitor	14	42	L	Stimulation chemical storage area	No
Mannanase (Mannan endo-1,4-beta-mannosidase)- cross linker	2	6	L	Stimulation chemical storage area	Yes
Nonoxynol-9- surfactant	9	27	L	Stimulation chemical storage area	Yes
2-Ethylhexanol PO/EO polymer- stabiliser	9	27	L	Stimulation chemical storage area	No
Corn oil- friction reducer	662	1,986	L	Stimulation chemical storage area	No
Sodium chloride	15,000	45,000	kg	Completion chemical storage area	No
ALDACIDE G	500	1,500	L	Completion chemical storage area	Yes
OXYGON	100	300	kg	Completion chemical storage area	No

Amended EMP text					
Sodium bromate- breaker	50,441	151,323	L	Stimulation chemical storage area	Yes
Hepta sodium phosphonate- emulsifier	3,176	9,528	L	Stimulation chemical storage area	No
Distillates, hydrotreated light- friction reducer	54,231	162,693	L	Stimulation chemical storage area	No
Guar gum- viscosity regulator	15,141	45,423	L	Stimulation chemical storage area	No
Poly-oxyethylene nonylphenol ether- surfactant	4,466	13,398	L	Stimulation chemical storage area	Yes
Quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with bentonite- biocide	4,466	13,398	L	Stimulation chemical storage area	Yes
1,6-Hexanediol- cross linker	447	1,341	L	Stimulation chemical storage area	Yes
Hydrochloric acid- pH control	44,715	134,145	L	Stimulation chemical storage area	Yes
N-benzyl-alkyl pyridinium chloride- pH control	28	84	L	Stimulation chemical storage area	Yes
Formic acid- corrosion inhibitor	38	114	L	Stimulation chemical storage area	Yes
Sodium erythorbate- scaler prohibitor	334	1,002	L	Stimulation chemical storage area	No
Citric acid- pH control	15,878	47,634	L	Stimulation chemical storage area	No
Acetic acid- pH control	15,878	47,634	L	Stimulation chemical storage area	No
Isopropanol- clay management	83	249	L	Stimulation chemical storage area	Yes
Ethoxylated C12-C16 alcohol - surfactant	57	171	L	Stimulation chemical storage area	Yes
Ethoxylated decanol - surfactant	19	57	L	Stimulation chemical storage area	Yes
Cinnamaldehyde- biocide	57	171	L	Stimulation chemical storage area	Yes
Ethoxylated tallow alkyl amine - surfactant	9	27	L	Stimulation chemical storage area	Yes
Methanol- corrosion inhibitor	2	6	L	Stimulation chemical storage area	Yes
Polyacrylamide - friction reducer	49,093	147,279	L	Stimulation chemical storage area	No
Polyethylene glycol trimethylnonyl ether - clay manager	87	261	L	Stimulation chemical storage area	Yes
Water in additive- stabiliser	66,804	200,412	L	Stimulation chemical storage area	No
Potassium sorbate food grade- corrosion inhibitor	14	42	L	Stimulation chemical storage area	No
Mannanase (Mannan endo-1,4-beta-mannosidase)- cross linker	2	6	L	Stimulation chemical storage area	Yes
Nonoxynol-9- surfactant	9	27	L	Stimulation chemical storage area	Yes
2-Ethylhexanol PO/EO polymer- stabiliser	9	27	L	Stimulation chemical storage area	No
Corn oil- friction reducer	662	1,986	L	Stimulation chemical storage area	No
AL-CI-1F - HT Acid Corrosion Inhibitor	1,022	3,066	L	Stimulation chemical storage area	Yes
AL-FE-1F - Iron Control	2,001	6,002	L	Stimulation chemical storage area	Yes

Interest holder	Tamboran B2 Pty Ltd	EMP Title	Beetaloo Sub-basin Shenandoah South E&A Program EMP	Unique EMP ID	TAM1-3	Mod #	4	Date	16 September 2024

Current EMP text

BARACOR 100	2,000	6,000	L	Completion chemical storage area	Yes
Sodium Hypochlorite 10–30%	10,000	30,000	L	Completion chemical storage area	Yes
CON-DET	50	150	kg	Drilling chemical storage area	No
SAPP	50	150	kg	Drilling chemical storage area	No
Bentonite	3,000	9,000	kg	Drilling chemical storage area	No
Caustic soda	1,400	4,200	kg	Drilling chemical storage area	No
EZ MUD DP or EZ MUD Liquid	2,000	6,000	kg	Drilling chemical storage area	No
ALDACIDE G	336	1008	kg	Drilling chemical storage area	Yes
STOPPIT	1,000	3,000	kg	Drilling chemical storage area	No
Soda ash	350	1050	kg	Drilling chemical storage area	Yes
BARACOR 100	250	750	kg	Drilling chemical storage area	Yes
Sodium chloride (flossy salt)	96,000	288,000	kg	Drilling chemical storage area	No
Barite	500	1,500	kg	Drilling chemical storage area	No
BARACARB	500	1,500	kg	Drilling chemical storage area	Yes
Citric acid	500	1,500	kg	Drilling chemical storage area	Yes
BARADEFOAM HP	500	1,500	kg	Drilling chemical storage area	No
Sodium Bicarbonate	500	1,500	kg	Drilling chemical storage area	No
PERFORMATROL	500	1,500	kg	Drilling chemical storage area	Yes
SOURSCAV	500	1,500	kg	Drilling chemical storage area	No
DRIL-N-SLIDE	500	1,500	kg	Drilling chemical storage area	No
STEELSEAL	500	1,500	kg	Drilling chemical storage area	Yes
BARAZAN D or BARAZAN D Plus	4,150	12,450	kg	Drilling chemical storage area	No
PAC L	2,300	6,900	kg	Drilling chemical storage area	Yes
Potassium chloride	22,500	67,500	kg	Drilling chemical storage area	No
QUIK-FREE	500	1,500	kg	Drilling chemical storage area	No
BAROFIBRE, BAROFIBRE Superfine and BAROFIBRE COARSE	500	1,500	kg	Drilling chemical storage area	No
BaraBlend-657	500	1,500	kg	Drilling chemical storage area	Yes
N-DRIL HT Plus	500	1,500	kg	Drilling chemical storage area	Yes
DEXTRID LTE	4,600	13,800	kg	Drilling chemical storage area	No
BARABUF	500	1,500	kg	Drilling chemical storage area	No
BDF 933 or BaraLube W-933	864	2,592	kg	Drilling chemical storage area	Yes
BAROLIFT	500	1,500	kg	Drilling chemical storage area	No
OXYGON	500	1,500	kg	Drilling chemical storage area	No
ENVIRO-THIN	500	1,500	kg	Drilling chemical storage area	No
Lime	500	1,500	kg	Drilling chemical storage area	Yes
Calcium chloride	37,000	111,000	kg	Drilling chemical storage area	Yes
Sodium bromide	8,610	24,480	kg	Drilling chemical storage area	Yes
Evolube TR	14,500	43,500	L	Drilling chemical storage area	Yes
Radiagreen EME	4,800	14,400	L	Drilling chemical storage area	Yes
Radiagreen EBL	4,800	14,400	L	Drilling chemical storage area	Yes
Polydrill	7,500	22,500	kg	Drilling chemical storage area	Yes

Amended EMP text

BFL-1F - Low Buffer	2,000	6,000	L	Stimulation chemical storage area	Yes
BHE-01F - Encapsulated AP	173	519	L	Stimulation chemical storage area	Yes
BIO-GQ510 - Biocide 5/10 Glut Quat	38,715	116,144	L	Stimulation chemical storage area	Yes
CSA-1F - Clay Control (70% Choline)	96,786	290,358	L	Stimulation chemical storage area	No
HCL-15B - 15% HCL	508,008	1,524,023	L	Stimulation chemical storage area	Yes
SFT-NE-1F - Flowback Surfactant (NE)	48,666	145,997	L	Stimulation chemical storage area	Yes
BFH-1F - High Buffer	2,000	6,000	L	Stimulation chemical storage area	Yes
FRP-BL1F - HVFR Anionic (Freshwater)	114,830	344,490	L	Stimulation chemical storage area	Yes
LGA-01F - Guar Gel Concentrate	13,594	40,781	L	Stimulation chemical storage area	Yes
SCI-1F - Scale Inhibitor	96,786	290,358	L	Stimulation chemical storage area	No
XLB-C1F - Instant Cross-linker	3,263	9,788	L	Stimulation chemical storage area	Yes
Sodium chloride	15,000	45,000	kg	Completion chemical storage area	No
ALDACIDE G	500	1,500	L	Completion chemical storage area	Yes
OXYGON	100	300	kg	Completion chemical storage area	No
BARACOR 100	2,000	6,000	L	Completion chemical storage area	Yes
Sodium Hypochlorite 10–30%	10,000	30,000	L	Completion chemical storage area	Yes
CON-DET	50	150	kg	Drilling chemical storage area	No
SAPP	50	150	kg	Drilling chemical storage area	No
Bentonite	3,000	9,000	kg	Drilling chemical storage area	No
Caustic soda	1,400	4,200	kg	Drilling chemical storage area	No
EZ MUD DP or EZ MUD Liquid	2,000	6,000	kg	Drilling chemical storage area	No
ALDACIDE G	336	1008	kg	Drilling chemical storage area	Yes
STOPPIT	1,000	3,000	kg	Drilling chemical storage area	No
Soda ash	350	1050	kg	Drilling chemical storage area	Yes
BARACOR 100	250	750	kg	Drilling chemical storage area	Yes
Sodium chloride (flossy salt)	96,000	288,000	kg	Drilling chemical storage area	No
Barite	500	1,500	kg	Drilling chemical storage area	No
BARACARB	500	1,500	kg	Drilling chemical storage area	Yes
Citric acid	500	1,500	kg	Drilling chemical storage area	Yes
BARADEFOAM HP	500	1,500	kg	Drilling chemical storage area	No
Sodium Bicarbonate	500	1,500	kg	Drilling chemical storage area	No
PERFORMATROL	500	1,500	kg	Drilling chemical storage area	Yes
SOURSCAV	500	1,500	kg	Drilling chemical storage area	No
DRIL-N-SLIDE	500	1,500	kg	Drilling chemical storage area	No
STEELSEAL	500	1,500	kg	Drilling chemical storage area	Yes
BARAZAN D or BARAZAN D Plus	4,150	12,450	kg	Drilling chemical storage area	No
PAC L	2,300	6,900	kg	Drilling chemical storage area	Yes
Potassium chloride	22,500	67,500	kg	Drilling chemical storage area	No
QUIK-FREE	500	1,500	kg	Drilling chemical storage area	No

Interest holder	Tamboran B2 Pty Ltd	EMP Title	Beetaloo Sub-basin Shenandoah South E&A Program EMP	Unique EMP ID	TAM1-3	Mod #	4	Date	16 September 2024

Current EMP text

Alpine spotting beads	1,000	3,000	kg	Drilling chemical storage area	Yes
Barite - weighting agent	354,000	1,062,000	kg	Drilling chemical storage area	No
Bio-Paq HT - filtration control	1,134	3,410	kg	Drilling chemical storage area	Yes
Brine-Pac XTS - corrosion inhibitor	3,400	10,200	L	Drilling chemical storage area	Yes
Calcium chloride - salinity	180,000	540,000	kg	Drilling chemical storage area	Yes
CF Desco - deflocculant	2,270	6,810	kg	Drilling chemical storage area	Yes
Chek Loss - fibrous LCM Cellulose	1,360	4,080	kg	Drilling chemical storage area	No
Citric acid - pH control	1,361	4,083	L	Drilling chemical storage area	Yes
Ecco-Temp - HT extender	8,000	24,000	L	Drilling chemical storage area	Yes
Flowzan - viscosifier	5,000	15,000	kg	Drilling chemical storage area	No
Mil-Lime alkalinity	1,361	4,083	L	Drilling chemical storage area	Yes
Magnesium oxide - pH buffer	7,500	22,500	kg	Drilling chemical storage area	No
Mil-bio SEA 98 - biocide	1,800	5,400	L	Drilling chemical storage area	Yes
Mil-carb - LCM / bridging	5,000	15,000	kg	Drilling chemical storage area	No
Milstarch filtration control	5,000	15,000	kg	Drilling chemical storage area	No
Navi-Lube - lubricant	16,650	49,980	L	Drilling chemical storage area	Yes
New-Drill Plus - shale stabiliser	1,000	3,000	kg	Drilling chemical storage area	No
Noxygen XT - oxygen scavenger	880	2,660	kg	Drilling chemical storage area	No
Ova Col 110 HC - cloud point glycol	13,000	39,000	kg	Drilling chemical storage area	Yes
Potassium chloride salt / shale stabiliser	40,800	122,500	kg	Drilling chemical storage area	Yes
Potassium hydroxide - pH source	1,250	3,750	kg	Drilling chemical storage area	Yes
Pyro-Trol II - HT filtration control	25	75	kg	Drilling chemical storage area	No
Pyro-Vis II - HT viscosifier	1,400	4,200	kg	Drilling chemical storage area	Yes
Soda ash - pH and hardness control	1,000	3,000	kg	Drilling chemical storage area	Yes
Sodium bicarbonate - pH and hardness control	1,000	3,000	kg	Drilling chemical storage area	No
Sodium chloride - salt	54,400	163,300	kg	Drilling chemical storage area	No
W.O. defoam - defoamer	600	1,820	L	Drilling chemical storage area	Yes
Xan-Plex D - viscosifier	3,000	9,000	kg	Drilling chemical storage area	No
TEQ-LUBE II - lubricant (25322-6-3)	14,400	43,200	kg	Drilling chemical storage area	Yes
TEQ-LUBE II - lubricant (39464-69-2)	14,400	43,200	kg	Drilling chemical storage area	Yes
NEW-THIN - Polymeric thinner	4,680	14,040	kg	Drilling chemical storage area	No
LC-LUBE - lubricant (graphite)	9,090	27,270	kg	Drilling chemical storage area	No
Diesel	250	750	KL	Diesel storage tanks	Yes

Amended EMP text

BAROFIBRE, BAROFIBRE Superfine and BAROFIBRE COARSE	500	1,500	kg	Drilling chemical storage area	No
BaraBlend-657	500	1,500	kg	Drilling chemical storage area	Yes
N-DRIL HT Plus	500	1,500	kg	Drilling chemical storage area	Yes
DEXTRID LTE	4,600	13,800	kg	Drilling chemical storage area	No
BARABUF	500	1,500	kg	Drilling chemical storage area	No
BDF 933 or BaraLube W-933	864	2,592	kg	Drilling chemical storage area	Yes
BAROLIFT	500	1,500	kg	Drilling chemical storage area	No
OXYGON	500	1,500	kg	Drilling chemical storage area	No
ENVIRO-THIN	500	1,500	kg	Drilling chemical storage area	No
Lime	500	1,500	kg	Drilling chemical storage area	Yes
Calcium chloride	37,000	111,000	kg	Drilling chemical storage area	Yes
Sodium bromide	8,610	24,480	kg	Drilling chemical storage area	Yes
Evolube TR	14,500	43,500	L	Drilling chemical storage area	Yes
Radiagreen EME	4,800	14,400	L	Drilling chemical storage area	Yes
Radiagreen EBL	4,800	14,400	L	Drilling chemical storage area	Yes
Polydrill	7,500	22,500	kg	Drilling chemical storage area	Yes
Alpine spotting beads	1,000	3,000	kg	Drilling chemical storage area	Yes
Barite - weighting agent	354,000	1,062,000	kg	Drilling chemical storage area	No
Bio-Paq HT - filtration control	1,134	3,410	kg	Drilling chemical storage area	Yes
Brine-Pac XTS - corrosion inhibitor	3,400	10,200	L	Drilling chemical storage area	Yes
Calcium chloride - salinity	180,000	540,000	kg	Drilling chemical storage area	Yes
CF Desco - deflocculant	2,270	6,810	kg	Drilling chemical storage area	Yes
Chek Loss - fibrous LCM Cellulose	1,360	4,080	kg	Drilling chemical storage area	No
Citric acid - pH control	1,361	4,083	L	Drilling chemical storage area	Yes
Ecco-Temp - HT extender	8,000	24,000	L	Drilling chemical storage area	Yes
Flowzan - viscosifier	5,000	15,000	kg	Drilling chemical storage area	No
Mil-Lime alkalinity	1,361	4,083	L	Drilling chemical storage area	Yes
Magnesium oxide - pH buffer	7,500	22,500	kg	Drilling chemical storage area	No
Mil-bio SEA 98 - biocide	1,800	5,400	L	Drilling chemical storage area	Yes
Mil-carb - LCM / bridging	5,000	15,000	kg	Drilling chemical storage area	No
Milstarch filtration control	5,000	15,000	kg	Drilling chemical storage area	No
Navi-Lube - lubricant	16,650	49,980	L	Drilling chemical storage area	Yes
New-Drill Plus - shale stabiliser	1,000	3,000	kg	Drilling chemical storage area	No
Noxygen XT - oxygen scavenger	880	2,660	kg	Drilling chemical storage area	No
Ova Col 110 HC - cloud point glycol	13,000	39,000	kg	Drilling chemical storage area	Yes
Potassium chloride salt / shale stabiliser	40,800	122,500	kg	Drilling chemical storage area	Yes
Potassium hydroxide - pH source	1,250	3,750	kg	Drilling chemical storage area	Yes

Interest holder	Tamboran B2 Pty Ltd	EMP Title	Beetaloo Sub-basin Shenandoah South E&A Program EMP	Unique EMP ID	TAM1-3	Mod #	4	Date	16 September 2024

Current EMP text

Hydraulic oil	1,000	3,000	L	Workshop	Yes
Engine oil	1,000	3,000	L	Workshop	Yes
Degreasers	100	300	L	Workshop	Yes
Waste drilling fluids	2,500	7,500	m^3	Drilling mud sump	Yes
Completion fluids	1.4	4.2	ML	Drilling mud sump	No
Condensate	10	10	KL	Drilling chemical storage area	Yes
Flowback	~10.8 ML per well		ML	Flowback tanks	Yes
Proppants*					
100 mesh sand	91,000	273,000	kg	Stimulation chemical storage area	No
Quartz or organophilic phyllosilicate- proppant	1,084	3,252	L	Stimulation chemical storage area	No
40/70 sand	1,650,000	4,950,000	kg	Stimulation chemical storage area	No
30/50 sand	610,000	1,830,000	kg	Stimulation chemical storage area	No
* Proppants are sand which is inert. They do not require special chemical bunding but are co-located in the stimulation chemical storage area, within the well pad bund. Residual proppant from a stimulation campaign is often used to assist with chemical spills on the well pad, where contaminated spill material is removed.					

Amended EMP text

Pyro-Trol II - HT filtration control	25	75	kg	Drilling chemical storage area	No
Pyro-Vis II - HT viscosifier	1,400	4,200	kg	Drilling chemical storage area	Yes
Soda ash - pH and hardness control	1,000	3,000	kg	Drilling chemical storage area	Yes
Sodium bicarbonate - pH and hardness control	1,000	3,000	kg	Drilling chemical storage area	No
Sodium chloride - salt	54,400	163,300	kg	Drilling chemical storage area	No
W.O. defoam - defoamer	600	1,820	L	Drilling chemical storage area	Yes
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TEQ-LUBE II - lubricant (39464-69-2)	14,400	43,200	kg	Drilling chemical storage area	Yes
NEW-THIN - Polymeric thinner	4,680	14,040	kg	Drilling chemical storage area	No
LC-LUBE - lubricant (graphite)	9,090	27,270	kg	Drilling chemical storage area	No
General operation chemicals					
Diesel	250	750	KL	Diesel storage tanks	Yes
Hydraulic oil	1,000	3,000	L	Workshop	Yes
Engine oil	1,000	3,000	L	Workshop	Yes
Degreasers	100	300	L	Workshop	Yes
Waste drilling fluids	2,500	7,500	m^3	Drilling mud sump	Yes
Completion fluids	1.4	4.2	ML	Drilling mud sump	No
Condensate	10	10	KL	Drilling chemical storage area	Yes
Flowback	~10.8 ML per well		ML	Flowback tanks	Yes
Proppants*					
100 mesh sand	91,000	273,000	kg	Stimulation chemical storage area	No
Quartz or organophilic phyllosilicate- proppant	1,084	3,252	L	Stimulation chemical storage area	No
40/70 sand	1,650,000	4,950,000	kg	Stimulation chemical storage area	No
30/50 sand	610,000	1,830,000	kg	Stimulation chemical storage area	No
Silicon dioxide (quartz/sand) 100% Sand	4,757,614	14,272,842	kg	Stimulation chemical storage area	No
Silicon dioxide (quartz/sand) 40/70	5,435,287	16,305,860	kg	Stimulation chemical storage area	No
* Proppants are sand which is inert. They do not require special chemical bunding but are co-located in the stimulation chemical storage area, within the well pad bund. Residual proppant from a stimulation campaign is often used to assist with chemical spills on the well pad, where contaminated spill material is removed.					
Cleaning chemicals and spill response					
Soda ash – sodium carbonate	3,750	11,250	kg	Stimulation chemical storage area - spill response for acid spills	Yes
Flush fluid - distillates (petroleum), hydrotreated	1,500	4,500	L	Stimulation chemical storage area - Equipment cleaning	Yes

Appendix E Chemical Risk Assessment
AECOM Australia Pty Ltd. 2024. *Beetaloo Exploration and Appraisal Program - Hydraulic Fracturing Chemical Risk Assessment*, prepared for Tamboran Resources, 8 June 2024.

Appendix E Chemical Risk Assessment
AECOM Australia Pty Ltd. 2024. *Beetaloo Exploration and Appraisal Program - Hydraulic Fracturing Chemical Risk Assessment*, prepared for Tamboran Resources, 8 June 2024.

Interest holder	Tamboran B2 Pty Ltd	**EMP Title**	Beetaloo Sub-basin Shenandoah South E&A Program EMP	**Unique EMP ID**	TAM1-3	**Mod #**	4	**Date**	16 September 2024

Current EMP text	**Amended EMP text**
Appendix E.1 - EHS Support. 2023. *Hydraulic Stimulation Chemical Risk Assessment – Tamboran Resources Northern Territory Tenements*, Prepared for Condor Energy, January 2024.	**Appendix E.1** - EHS Support. 2023. *Hydraulic Stimulation Chemical Risk Assessment – Tamboran Resources Northern Territory Tenements*, Prepared for Condor Energy, January 2024. **Appendix E.2** – AECOM Australia Pty Ltd. 2024. *Beetaloo Exploration and Appraisal Program – Chemical Risk Assessment*, prepared for Fusion Technologies (Australia) Pty Ltd, 5 Septenber 2024.

Prepared for
Fusion Technologies (Australia) Pty Ltd
ABN: 50 636538 960

AECOM

Beetaloo Exploration and Appraisal Program - Stimulation Chemical Risk Assessment

Beetaloo Sub-basin, NT

20-Dec-2024

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Beetaloo Exploration and Appraisal Program - Stimulation Chemical Risk Assessment

Beetaloo Sub-basin, NT

Client: Fusion Technologies (Australia) Pty Ltd

ABN: 50 636538 960

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Date	20-December-2024
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Reviewed by	Michael Archer

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	19-Aug-2024	Draft	Michael Archer Technical Review	
A	19-Aug-2024	Draft	Perri Braithwaite Project Manager	
B	29-Aug-2024	Final Draft	Michael Archer Technical Review	
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C	16-Sept-2024	Final Draft	Michael Archer Technical Review	
C	16-Sept-2024	Final Draft	Perri Braithwaite Project Manager	
0	20-Dec-2024	Final	Michael Archer Technical Review Perri Braithwaite Project Manager	

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1.0 Introduction

Fusion Technologies (Australia) Pty Ltd. commissioned AECOM Australia Pty Ltd (AECOM) to perform a Chemical Risk Assessment (CRA) for the upcoming hydraulic fracturing stimulation event in the Beetaloo Basin. It is AECOM's understanding that the CRA is required to assess the potential human health and environmental effects of the chemicals proposed to be used in Tamboran Pty Ltd (Tamboran) and Liberty Pty Ltd (Liberty) Exploration and Appraisal Program. It is noted that Fusion Technologies is the chemical provider, and the stimulation activities will be jointly undertaken by Tamboran and Liberty.

1.1 Scope

The CRA was undertaken to assess the potential human health and environmental effects of the chemicals proposed to be used during the stimulation event. Specifically, the following was assessed:

- Stimulation Fluid

The chemical composition of the stimulation fluid is provided in the mass balance presented in **Appendix A**. It is noted that two contingency products (Soda Ash and Flush Fluid) have not been included in the stimulation fluid recipe. Soda Ash is used as a spill response measure and Flush Fluid is used for equipment cleaning, and as such are not considered as stimulation fluid.

1.2 Approach

This risk assessment aligns with the *Northern Territory Government, Department of Environment, Parks and Water Security, Environment Management Plan Content Guideline, 2021* (herein referred to as DEPWS 2021) and is in accordance with requirements of the *Petroleum (Environment) Regulations 2016* (herein referred to as the Regulations).

The methods used for this chemical risk assessment also follow the guidance provided by the *Department of the Environment and Energy, Exposure Draft - Chemical Risk Assessment Guidance Manual: for chemicals associated with coal seam gas extraction, 2017* (DoEE, 2017) and the methodology adopted for the chemical risk assessment is in general accordance with the following:

- Australian Industrial Chemicals Introduction Scheme (AICIS) (formerly National Industrial Chemicals Notifications and Assessment Scheme (NICNAS)), National Assessment of Chemicals Associated with Coal Seam Gas Extraction in Australia, 2017 (herein referred to as NICNAS 2017), which includes the approach outlined in the National Chemical Risk Assessment Guidance Manuals published by the National Environmental Protection Council (NEPC)
- enHealth. Environmental Health Risk Assessment, Guidelines for Assessing Human Health Risks from Environmental Hazards, 2012
- National Environment Protection (Assessment of Site Contamination) Measure 1999 (ASC NEPM); Schedule B4, Site-specific health risk assessment methodology, 2013

This chemical risk assessment comprised the following tasks:

- Hazard assessment. An evaluation of the environmental hazard of the chemical additives in the hydraulic fracturing fluid systems, based on their environmental persistence, bioaccumulation and aquatic toxicity properties. Also included was an evaluation of potential human health effects (i.e. genotoxicity, carcinogenicity, reproductive toxicity, oral toxicity, inhalation toxicity, dermal toxicity, chronic repeated dose toxicity).
- Exposure assessment. The exposure assessment comprised of an evaluation of surface and sub-surface exposure pathways and mass balance calculation to identify the amount of each chemical additive of the hydraulic fracturing fluid system.
- Screening and validation processes via Tier 1 and Tier 2 assessments. Determination of chemicals known to be of low concern, and identification of chemicals for further risk assessment.

- Tier 1: using published information about each chemical proposed to be used in the hydraulic fracturing fluid systems.
- Tier 2: A quantitative evaluation of the potential risks using toxicity values and quantitative estimates of chemical intake to provide an estimate of potential human health risk associated with the hydraulic fracturing activities, based on the identification of complete exposure pathways using generic field level information and hazard identification.

2.0 Tier 1 Screen

2.1.1 Tier 1 Screen Methodology

The screening process for the hydraulic fracturing chemicals in the human health assessment is consistent with the approach outlined in DoEE (2017) and Appendix C of DEPWS (2021).

The following general approach was used to screen the chemicals of potential concern (COPCs):

- If the chemicals are found on any of the following national or international lists of substances applicable to chemicals associated with coal seam gas extraction as being of low concern, then a Tier 2 assessment was deemed not to be warranted.
  - AICIS Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier 1 Lists
  - National Assessment of Chemicals Associated with Coal Seam Gas Extraction in Australia, Technical Report Number 11. Chemicals of low concern for human health based on initial assessment of hazards (NICNAS 2017a)
  - USEPA High Production Volume (Indicator 1)[1]
  - REACH Annex IV[2].
- If the chemical was not listed as a chemical of low concern (i.e. due to not being previously evaluated by national/international agencies) but was not a PBT substance and no human health hazard was identified, then a Tier 2 assessment was deemed not to be warranted.

The outcome of the Tier 1 assessment identifies the chemicals of low human health and environmental concern for which no further management or mitigation is considered necessary.

2.1.2 Outcome of Tier 1 Screen

Comparison of the chemicals in **Table 1** with the assessment criteria as presented in DoEE (2017) and in Appendix C of DEPWS (2021) indicated that 19 chemicals were not considered to require a Tier 2 assessment. Further, 11 of those chemicals have been assessed by AICIS under the IMAP framework and were identified to be of low concern to human health and/or the environment.

Table 1 Chemicals identified to be of low concern (Tier 1)

CAS	Chemical	Reasoning
9003-05-8	Polyacrylamide	A Tier 1 assessment under the AICIS IMAP assessment framework has been conducted which concluded that this chemical poses no unreasonable risk to human health and the environment. The chemical is not classified as PBT and its ecotoxicity is low based on available acute data. A Tier 2 assessment is not required.
107-21-1	Ethylene glycol	A Tier 1 assessment under the AICIS IMAP assessment framework has been conducted which concluded that this chemical poses no unreasonable risk to the environment. The chemical is not classified as PBT and its ecotoxicity is low based on available acute data. It is noted that the chemical causes systemic acute effects to human health particularly acute toxicity by the oral route of exposure. Management of this chemical is addressed in the EMP to prevent accidental release. OH&S procedures implemented by Tamboran will minimise human health exposure. A Tier 2 assessment is not required.

[1] The US EPA High Production Volume (HPV) chemicals are those which are manufactured in or imported into the US in amounts ≥ 1million pounds/year. Indicator 1 denotes those chemicals not considered a candidate for testing, based on a preliminary US EPA review indicating testing would not further our understanding of the chemical's properties (NICNAS 2017).
[2] Annex IV of the European REACH regulation (i.e. Registration; Evaluation; Authorisation; and restriction of Chemicals) contains a list of substances exempt from registration on the basis that they are considered to cause minimum risk due to their intrinsic properties (NICNAS 2017)

CAS	Chemical	Reasoning
1310-73-2	Sodium hydroxide (caustic soda)	A Tier 1 assessment under the AICIS IMAP assessment framework has been conducted which concluded that this chemical poses no unreasonable risk to the environment. It is noted that the chemical is corrosive to the skin, eyes and gastrointestinal and respiratory tracts. Management of this chemical is addressed in the EMP to prevent accidental release. OH&S procedures implemented by Tamboran will minimise human health exposure. A Tier 2 assessment is not required.
14807-96-6	Talc	A Tier 1 assessment under the AICIS IMAP assessment framework has been conducted which concluded that this chemical poses no unreasonable risk to human health and the environment. A Tier 2 assessment is not required.
14808-60-7	Crystalline silica, quartz	The risk was classified as low based on acute data. The chemical is not classified as PBT. It is noted that the chemical is hazardous to human health via the inhalation pathways and as such OH&S procedures will be implemented by Tamboran will minimise human health exposure. Management of this chemical is addressed in the EMP to prevent accidental release. A Tier 2 assessment is not required.
Proprietary	Proprietary	A Tier 1 assessment under the AICIS IMAP assessment framework has been conducted which concluded that this chemical poses no unreasonable risk to human health. The chemical is not classified as PBT and its ecotoxicity is low based on available chronic data. A Tier 2 assessment is not required.
Proprietary	Proprietary	A Tier 1 assessment under the AICIS IMAP assessment framework has been conducted which concluded that this polymer poses no unreasonable risk to human health and the environment. The chemical is not classified as PBT. A Tier 2 assessment is not required.
497-19-8	Sodium carbonate	A Tier 1 assessment under the AICIS IMAP assessment framework has been conducted which concluded that this chemical poses no unreasonable risk to the environment. The chemical is not classified as PBT and its ecotoxicity is low based on available acute data. It is noted that the chemical may cause serious eye damage and respiratory irritation. Management of this chemical is addressed in the EMP to prevent accidental release. OH&S procedures implemented by Tamboran will minimise human health exposure. A Tier 2 assessment is not required.
64-18-6	Formic Acid	The risk was classified as low based on acute data. The chemical is not classified as PBT. The exposure concentration is below the respective ecotoxicity values. It is noted that the chemical is corrosive. Management of this chemical is addressed in the EMP to prevent accidental release. OH&S procedures implemented by Tamboran will minimise human health exposure. A Tier 2 assessment is not required.
6381-77-7	Sodium erythorbate	A Tier 1 assessment under the AICIS IMAP assessment framework has been conducted which concluded that this chemical poses no unreasonable risk to human health. This substance is not classified as PBT and its ecotoxicity

CAS	Chemical	Reasoning
		is low based on available chronic data. A Tier 2 assessment is not required.
64-19-7	Acetic acid	A Tier 1 assessment under the AICIS IMAP assessment framework has been conducted which concluded that this chemical poses no unreasonable risk to the environment. It is noted that the chemical is corrosive. Management of this chemical is addressed in the EMP to prevent accidental release. OH&S procedures implemented by Tamboran will minimise human health exposure. A Tier 2 assessment is not required.
67-48-1	Choline chloride	A Tier 1 assessment under the AICIS IMAP assessment framework has been conducted which concluded that this chemical poses no unreasonable risk to human health and the environment. A Tier 2 assessment is not required.
9000-30-0	Guar gum	A Tier 1 assessment under the AICIS IMAP assessment framework has been conducted which concluded that this chemical poses no unreasonable risk to human health. The chemical is not classified as PBT and its ecotoxicity is low based on available acute data. A Tier 2 assessment is not required.
Proprietary	Proprietary	This chemical has been listed by AICIS as a chemical unlikely to require further regulation to manage risks to health. A Tier 2 assessment is not required.
Proprietary	Proprietary	This chemical has been listed by AICIS as a chemical unlikely to require further regulation to manage risks to health. A Tier 2 assessment is not required.
Proprietary	Proprietary	This chemical has been listed by AICIS as a chemical unlikely to require further regulation to manage risks to health. A Tier 2 assessment is not required.
68909-18-2	Alkyl Pyridines Quat	This chemical is not classified as PBT. It is noted that the chemical is a corrosive substance for which dermal absorption is considered likely to be very low. The effects of dermal exposure will be dominated by those at the site of contact (i.e. local effects) and systemic toxicity is considered to be unlikely. As such OH&S procedures implemented by Tamboran will minimise human health exposure. Management of this chemical is addressed in the EMP to prevent accidental release. A Tier 2 assessment is not required.
7647-01-0	Hydrochloric acid	The risk was classified as low based on chronic data. The chemical is not classified as PBT. It is noted that the chemical is corrosive. Management of this chemical is addressed in the EMP to prevent accidental release. OH&S procedures implemented by Tamboran will minimise human health exposure. A Tier 2 assessment is not required.
7727-54-0	Diammonium peroxidisulphate	The risk was classified as moderate based on acute data. The substance is inorganic and ubiquitous in the environment. The exposure concentration is below the respective ecotoxicity values. A Tier 2 assessment is not required.

Seven of the chemicals from the stimulation fluid recipe are proprietary. In accordance with s.105 of the *Industrial Chemical Act 2019*, for the proprietary chemicals, the CAS number and name have been redacted from the public submission to protect the intellectual property of chemical manufacturer. Although the proprietary details of the chemical have been redacted in this report, AECOM had access to the chemical name and CAS number and the assessment of risk from the redacted chemical is presented in this report.

Based on the Tier 1 screening, 11 chemicals were identified to require a Tier 2 assessment:

- Hydrotreated light petroleum distillate (64742-47-8)
- Polyethylene glycol trimethylnonyl ether (127087-87-0)
- Boric acid (10043-35-3)
- Proprietary Chemical
- Isotridecanol, ethoxylated (69011-36-5)
- Cinnamaldehyde (104-55-2)
- Nonoxynol-9 (26571-11-9)
- Glutaraldehyde (111-30-8)
- Proprietary Chemical
- Didecyldimethylammonium Chloride (7173-51-5)
- Benzalkonium Chloride (8001-54-5).

It is to be noted that none of these chemicals were identified to be PBT (i.e., none of the organic chemicals meet all three criteria of being persistent *and* bioaccumulative *and* toxic).

The Tier 1 screening is provided in **Appendix B**, the chemical toxicological profiles are provided in **Appendix C** and the SDS are provided in **Appendix D.**

3.0 Tier 2 Screen

3.1.1 Tier 2 Screen Methodology

The purpose of the risk characterisation portion of the assessment is to provide a conservative estimate of the potential risk resulting from exposure to the COPCs that may occur during hydraulic fracturing activities. The risk characterisation evaluates the toxicity of the COPC and characterises the risk of the chemical assessed for specific exposure pathways identified below.

A two-stage process is employed during risk characterisation. First, risk ratios are developed for the chemical for potentially complete exposure pathways associated with applicable release scenarios. For the assessment of the overall potential for adverse human health effects posed by simultaneous exposure to multiple chemicals, the estimated daily intake of the chemicals by inhalation and direct (ingestion and dermal) contact were compared to tolerable daily intakes to calculate an individual hazard quotient (HQ) and then summed for all constituents into a hazard index (HI). The identification of toxicity values undertaken in this risk assessment has followed DoEE (2017), NICNAS (2017) and enHealth (2012) guidance. The toxicity values selected for this assessment were from Level 1 or 2 sources such as NICNAS (2017), AICIS, or the European Chemicals Agency (ECHA) REACH databases.

Consistent with Australian risk assessment methodologies, if the HI is less than or equal to 1, then no adverse health effects are likely associated with exposures and no risk / hazard reduction measures are required. There should be no need for further management controls on the chemical additional to those already in place (DoEE, 2017).

However, if the total HI is greater than 1, adverse health effects may be possible and therefore the assumptions inherent in the risk characterisation process warrant further evaluation via Tier 3 analysis.

3.1.2 Conceptual Exposure Model

Based on the risk mitigation measures identified in the NT Government *Scientific Inquiry into Hydraulic Fracturing in the Northern Territory*, the *Code of Practice for Onshore Petroleum Activities* in the Northern Territory (the Code) and mitigation measures outlined by Tamboran in its EMPs, no potentially complete exposure pathways were identified for hydraulic fracturing chemicals to impact groundwater that is used for beneficial uses in the project area. The specific controls implemented by Tamboran focussed on the protection of aquifers follow industry standard practice and include:

- the physical vertical separation distances of 1,400 m between the aquifer and target formation to prevent any migration of stimulation fluid to aquifer units
- the horizontal separation distance between the exploration well and the closest groundwater extraction bores of at least 1 km, as per the Code
- use of double lined wastewater tanks with leak detection
- implementation of spill management plan
- use of enclosed tanks and freeboard requirements
- mandatory secondary containment requirements.

Potential exposures to hydraulic fracturing chemicals at the project area were therefore assessed to be limited to the above ground storage and handling of flowback water. Management of flowback water involves temporary storage in above ground fluid holding tanks for evaporation. To enhance the evaporation of the flowback water prior to off-site transportation, floating evaporator units are deployed in the above ground fluid holding tanks for a maximum duration of 1 year.

The Tier 2 assessment evaluated the toxicity of the individual chemicals and characterised the cumulative risks of the total fluid mixtures to Workers. The methodology incorporated an assessment of potential exposures to the Workers, with the following identified as the only potentially complete exposure pathways:

- Incidental ingestion and dermal contact of flowback fluid by Workers during the hydraulic stimulation period for a maximum duration of 1 month; and

- Inhalation of mist from the evaporation units at the flowback tank by Workers for a maximum duration of 1 year.

These scenarios are also deemed protective of the following due to the less frequent and short duration of these exposures occurring:

- Worker exposure during a spill (i.e., a coupling breaks on a tank and releases product onto the worker) or leak scenarios.

Exposure parameters were selected based on a combination of default assumptions for workers from ASC NEPM, enHealth (2012) and site-specific information from Tamboran (i.e. if personal protective equipment is used). Exposure parameters are provided in **Appendix B** and toxicological profiles are provided in **Appendix C**.

3.1.3 Chemicals of Potential Concern

Exposure point concentrations (EPC) for the COPC were provided to AECOM by the chemical provider (Fusion Technologies). It was conservatively assumed that 100% of the mass of the chemicals injected into the well will be present in the hydraulic fracturing fluid. The EPCs are presented in **Appendix B**.

A summary of the chemicals and their EPCs that require further assessment are presented in **Table 2**.

Table 2 Chemicals requiring further assessment (Tier 2)

CAS	Chemical Name	EPC (mg/L)
64742-47-8	Hydrotreated light petroleum distillate	396[A]
127087-87-0	Polyethylene glycol trimethylnonyl ether	9
10043-35-3	Boric acid	8
Proprietary	Proprietary	98
Proprietary	Proprietary	95
69011-36-5	Isotridecanol, ethoxylated	63
104-55-2	Cinnamaldehyde	3
26571-11-9	Nonoxynol-9	1
111-30-8	Glutaraldehyde	25
7173-51-5	Didecyldimethylammonium Chloride	21
8001-54-5	Benzalkonium Chloride	23

Note: A - It is noted that the concentration for hydrotreated light petroleum distillate exceeds theoretical solubility and as such, potential direct exposure to non-aqueous phase liquid (NAPL) is hazardous to human health. Occupational health and safety (OH&S) procedures will be implemented by Tamboran to minimise human exposure.

Toxicity reference values (TRVs) were selected to be consistent with the TRVs used in the National Assessment of Chemicals Associated with Coal Seam Gas Extraction in Australia (NICNAS 2017) and benchmarked with other regulator approved CRAs of similar operations in the Bowen, Surat and Beetaloo Basins.

3.1.4 Outcome of Tier 2 Screen

For the assessment of the overall potential for adverse human health effects posed by simultaneous exposure to multiple chemicals, the estimated daily intake of each COPC (via incidental ingestion and dermal contact) were compared to tolerable daily intakes to calculate an individual hazard quotient (HQ) and then summed for all COPC into a hazard index (HI).

A summary of the estimated potential risks for the Workers that are relevant to the assessment of potential exposure to COPCs in hydraulic fracturing fluids on-site, based on the available data is presented in **Table 3**. The Tier 2 screening risk calculations are provided in **Appendix B**.

Table 3 Risk associated with potential exposure to Workers

Receptor and Pathway	Threshold Hazard Index
	100% Mass Return
Worker - Exposure to stimulation fluid	
Ingestion of chemicals via incidental contact with stimulation fluid	0.006
Dermal exposure to chemicals via incidental contact with stimulation fluid	0.001
Inhalation of mist from the evaporation units containing flowback water	0.03
Total Hazard Index	**0.04**

The following can be concluded from the Tier 2 screening:

- The estimated HI associated with potential exposure to COPC identified in stimulation fluid and assuming 100% mass recovery, is below the target 1, hence, potential risks are considered to be acceptable.

4.0 Chemical Transport, Storage and Handling

AECOM understands that Tamboran and Liberty aligns its transport, storage, and handling of hazardous chemicals with WHS Regulations, and the prescribed chemical legislation including all obligations and duties for storage and handling of hazardous chemicals and eliminating risks to workers from potential exposure and the potential requirements for health monitoring. For further information, refer to Liberty's Australian Health, Safety & Environment Handbook (Liberty, 2024) and chemical specific procedure documents [Acid Operations and Transfers (Liberty, 2018) and Frac Chemical Operations (Liberty, 2021)].

Further, it is assumed that the following prescribed chemical legislation, as defined by the *Petroleum (Environment) Regulations 2016*, will be followed as it relates to the transport, storage, and handling of hydraulic fracturing chemicals:

- *Medicines, Poisons and Therapeutic Goods Act 2012 and Medicines, Poisons and Therapeutic Goods Regulations 2014*
- *Dangerous Goods Act 1998*
- *Water Act 1992*
- *Waste Management and Pollution Control Act 1998*
- *Work Health and Safety (National Uniform Legislation) Act 2011*
- *Radiation Protection Act 2004.*

5.0 References

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Appendix A

Mass Balance

Appendix A - Hydraulic Fluid Systems Mass Balance

Stimulation Fluid Recipe							
Chemical Name	**CAS Number**	**Density (kg/L)**	**Volume of Chemical (L)**	**Volume Fraction (%v/v)**	**Chemical Mass in Fluid (kg)**	**Mass Fraction (% w/w)**	**Concentration in Injected Fluid (mg/L)**
Polyacrylamide	9003-05-08	1.189	68898	0.040107%	81920	0.044%	499
Boric acid	10043-35-3	1.49	835	0.000486%	1243	0.001%	8
Cinnamaldehyde	104-55-2	1.05	409	0.000238%	429	0.000%	3
Ethylene glycol	107-21-1	1.36	16831	0.009798%	22890	0.012%	139
Gluteraldehyde	111-30-8	1.1	3871	0.002253%	4103	0.002%	25
Polyethylene glycol trimethylnonyl ether	127087-87-0	1.04	1495	0.000870%	1555	0.001%	9
Sodium hydroxide (caustic soda)	1310-73-2	2.13	2335	0.001359%	4974	0.003%	30
Talc, Magnesium Silicate	14807-96-6	2.7	3	0.000002%	8	0.000%	0.05
Organophilic phyllosilicate	14808-60-7	2.65	571	0.000332%	1513	0.001%	9
[redacted]	[redacted]	1.945	38714	0.022536%	75299	0.041%	459
[redacted]	[redacted]	1.78	87	0.000051%	155	0.000%	0.9
Nonoxynol-9	26571-11-9	1.06	102	0.000059%	108	0.000%	0.7
Sodium carbonate	497-19-8	2.532	157	0.000091%	398	0.000%	2
Sodium erythorbate	6381-77-7	1.95	4001	0.002329%	7818	0.004%	48
Formic acid	64-18-6	1.22	409	0.000238%	499	0.000%	3
Acetic acid	64-19-7	1.04	3000	0.001746%	3120	0.00%	19
Petroleum Distillates (Hydrotreated, Light)	64742-47-8	0.8	81241	0.047292%	64993	0.035%	396
Choline Chloride	67-48-1	1.1	135500	0.078877%	149050	0.081%	908
[redacted]	[redacted]	0.959	584	0.000340%	560	0.000%	3
[redacted]	[redacted]	1.054	15184	0.008839%	16004	0.009%	98
Alkyl Pyridines Quat	68909-18-2	1.1	256	0.000149%	283	0.000%	2
Isotridecanol, ethoxylated	69011-36-5	0.9	11483	0.006684%	10415	0.006%	63
Hydrochloric acid	7647-01-0	1.15	152402	0.088716%	175567	0.095%	1070
Ammonium Persulphate	7727-54-0	2.0	256	0.000149%	512	0.000%	3
[redacted]	[redacted]	0.907	17228	0.010029%	15626	0.008%	95
Guar gum	9000-30-0	1	12778	0.007438%	12778	0.007%	78
Didecyldimethylammonium Chloride	7173-51-5	0.87	3871	0.002253%	3368	0.002%	21
Benzalkonium Chloride	8001-54-5	0.98	3871	0.002253%	3794	0.002%	23
[redacted]	[redacted]	0.959	2044	0.001190%	1960	0.001%	12
[redacted]	[redacted]	0.959	681	0.000396%	653	0.0%	4
Proppants							
Silicon Dioxide (quartz / sand) 100 # Sand	14808-60-7	2.65	3,590,652	2.09019%	9515228	5.2%	
Silicon Dioxide (quartz / sand) 40/70	14808-60-7	2.65	4,102,103	5.7442820%	10870573	5.9%	
Water							
Water in additives	7732-18-5	1	1,276,583	0.743123%	1276583	0.7%	
Water	7732-18-5	1	162,237,728	94.442%	162237728	88.0%	
Total Chemical Additives			579097		542,958	0.3%	
Total Proppant			7692755		20385801	11.1%	
Total Water (in additives)			1,276,583		1276583	0.7%	
Total Make Up Water			162237728		162237728	88.0%	

The mass balance also estimates the concentration of each chemical that will be returned to surface during the flowback of two hydraulically fractured wells, based on an upper estimate of 100% mass recovery

Appendix B

Tier 1 and Tier 2 Risk Screen Calculations

Fusion Recipe - Stimulation Fluid

Chemical Name	CAS Number	Volume or Mass of Chemical (L or kg)	Concentration in Injected Fluid (mg/L)	Parent Compound Purpose	Ecotoxicity[2]	Toxicity[2]	Biodegradation[1,3]	Bioaccumulative[1]	Tier 1 Screening Assessment	Discussion	Tier 2 Assessment Worker Ingestion Risk	Tier 2 Assessment Worker Dermal Risk	Tier 2 Assessment Worker Aerosol Inhalation Risk	Hazard Quotient	Outcome of Tier 2 Worker Risk Assessment[4]
Polyacrylamide	9003-05-08	68,898	499	Friction Reducer	Fathead minnow LC50: 810 mg/L Rainbow trout LC50: > 100 mg/L Bluegill sunfish LC50: >300 mg/L Daphnia magna LC50: 470 mg/L	Based on acute: Low	Yes. Anionic polyacrylamide is a large molecular weight, water-soluble polymer. It is not expected to be readily biodegradable; thus, it meets the screening criteria for persistence.	No, it is not expected to meet the criteria for bioaccumulation.	Tier 1 (MAP)	A Tier 1 Environmental Assessment for this chemical has been conducted by NICNAS which concluded that it was low concern to the environment. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
Boric acid	10043-35-3	835	8	Cross-linker	Chronic Daphnia (6 mg/L) and Fish (2.1 mg/L).	Based on chronic: Moderate	N.A (Inorganic)	N.A (Inorganic)	Tier 2	The risk was classified as moderate based on chronic data. The exposure concentration is above the respective ecotoxicity values. A Tier 2 assessment is required.	4.8E-05	5.6E-08	2.7E-04	3.2E-04	Based on the calculated HQ the chemical is of low concern for workers (refer to individual toxicity profile and risk calculations for further detail).
Cinnamaldehyde	104-55-2	409	3	Corrosion inhibitor	Danio rerio (Zebrafish) 96 h LC50 = 3.1 mg/L; Daphnia magna (Water flea) 48 h EC50 = 3.66 mg/L; Pseudokirchneriella subcapitata (Green algae) 72 h EC50 = 4.07 mg/L 72 h NOEC value = 2.0 mg/L Pseudokirchneriella subcapitata (Green algae)	Based on Chronic: Moderate	Not Persistent. Based on the results of the ready biodegradability studies, cinnamaldehyde is categorised as Not Persistent.	Not Bioaccumulative. Based on low log K values and/or expected natural metabolism and regulation of internal concentrations, the chemical is categorised as Not Bioaccumulative.	Tier 2	The risk was classified as moderate based on chronic data. The exposure concentration is above the respective ecotoxicity values. A Tier 2 assessment is required.	4.6E-06	3.0E-08	2.6E-05	3.0E-05	Based on the calculated HQ the chemical is of low concern for workers (refer to individual toxicity profile and risk calculations for further detail).
Ethylene glycol	107-21-1	16,831	139	Anti-freeze	LC50 for fish = 22800 mg/L LC50 for Daphnia =7800 mg/L NOEC for Algae >100 mg/L	Based on Acute: Low	Readily biodegradable	No based on the measured log Kow of -1.36 and a measured BCF of 10	Tier 1 (MAP)	A Tier 1 Environmental Assessment for this chemical has been conducted by NICNAS which concluded that it was low concern to the environment. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
Glutaraldehyde	111-30-8	38,714	25	Biocide	96 h acute Bluegill sunfish LC50 = 11.2 mg/L 48 h acute Oyster larvae LC550 = 2.1 mg/L 96 h acute Green crabs LC50 = 485 mg/L 96 h acute Grass shrimp LC50 = 41 mg/L 48 acute Daphnia magna LC50 = 0.35 mg/L 48 acute Daphnia magna LC50 = 16.3 mg/L 21 d reproduct'n Daphnia magna LOEC = 4.3 mg/L, NOEC = 2.1 mg/L 96 h algal growth inhibition Selenastrum capricornutm ILm = 3.9 mg/L (median inhibitory limit) 96 h algal growth inhibition Scenedesmus subspicatus EC50 = 1.0 mg/L Bacterial inhibition freeze microbes IC50 = 25.34 mg/L	Based on Chronic: Moderate	Readily biodegradable	No based on the Log Pow of -0.01	Tier 2	The risk was classified as moderate based on chronic data. The exposure concentration is above the respective ecotoxicity values. A Tier 2 assessment is required.	2.2E-03	9.0E-07	1.2E-02	1.4E-02	Based on the calculated HQ the chemical is of low concern for workers (refer to individual toxicity profile and risk calculations for further detail).
Polyethylene Glycol Trimethylnonyl Ether	127087-87-0	1,495	9	Emulsifier	Read across from CAS 9016-45-9 (Polyoxyethylene Nonylphenol Ether) Acute: Fish: 96 h EC50 = 1.3 mg/L (Lepomis macrochirus) Invertebrates: 48 h EC50 = 1.821 mg/L (DSMS) Algae: 5 d EC50 = 37.4 mg/L (Scenedesmus spinformis), Gallery worm: 48 h LC50 = 5.28 mg/L (Daphnia carpitata) Chronic Fish: 21 d NOEC = 0.048 mg/L (Oncorhynchus mykiss) (read across from nonylphenol monoethoxylate) Invertebrates: 6 d NOEC = 1.0 mg/L (Daphnia magna) Algae: 96 h NOEC = 8.0 mg/L (Pseudokirchneriella subcapitata)	Based on Chronic: Very High	No. Based on results obtained from biodegradation studies, this chemical is categorised as Not Persistent.	No. Based on the available measured bioconcentration data, this chemical is categorised as Not Bioaccumulative.	Tier 2	The risk was classified as very high based on chronic data. The exposure concentration is above the respective ecotoxicity values. A Tier 2 assessment is required.	2.2E-04	1.1E-06	1.2E-03	1.5E-03	Based on the calculated HQ the chemical is of low concern for workers (refer to individual toxicity profile and risk calculations for further detail).
Sodium hydroxide	1310-73-2	2,335	30	pH Buffer	Measured acute endpoints were available for fish (196 mg/L) Measured chronic endpoint were available for Daphnia (240 mg/L)	Based on Chronic: Low	N.A (Inorganic)	N.A. (Inorganic)	Tier 1 (MAP)	A Tier 1 Environmental Assessment for this chemical has been conducted by NICNAS which concluded that it was low concern to the environment. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
Talc	14807-96-6	3	0	Filler for encapsulate	No data	Based on low bioavailability: Low	Not readily biodegradable	Not bioaccumulative	Tier 1 (MAP)	A Tier 1 Human Health Assessment for this chemical has been conducted by NICNAS which concluded that this chemical was identified as low concern to human health. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
Crystalline silica, quartz	14808-60-7	571	9	Suspension agent	No acute toxicity to fish, Daphnia, or algae, though some physical effects were observed with loading rates of greater than or equal to 10 g/L (OECD 2004). Any harmful effects to aquatic ecosystems are therefore not ecotoxicological in nature. No chronic toxicity data was identified.	Based on Acute: Low	N.A (Inorganic)	N.A. (Inorganic)	Tier 1	The risk was classified as low based on acute data. The substance is not classified as PBT. It is noted that the substance is hazardous to human health via the inhalation pathways and as such OH&S procedures will be implemented by Tamboran will minimise human health exposure. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
[redacted]	[redacted]	38,714	459	Scale inhibitor	96-h LC50 for the rainbow trout is in the range 180-252 mg/L. EC50 values determined in acute tests with aquatic invertebrates are all in excess of 150 mg/L. Chronic/condensed toxicity to fish (60-day NOEC = 25.6 mg/L).	Based on chronic: Low	Potentially. Not rapidly degradable.	No. Based on the low log Kow (-3.40) and read-across from related substances.	Tier 1 (MAP)	A Tier 1 Human Health Assessment for this chemical has been conducted by NICNAS which concluded that this chemical was identified as low concern to human health. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
[redacted]	[redacted]	87	0.9	Surface coating	No data	No data	The polymers are synthetic addition polymers with stable carbon-chain backbones. If released to the environment, the polymers in this group are not expected to undergo rapid degradation.	The polymer is expected to have a very high molecular weight and poor water solubility. Therefore, this polymer is considered to be not bioaccumulative	Tier 1 (MAP)	A Tier 1 Human Health Assessment for this chemical has been conducted by NICNAS which concluded that this chemical was identified as low concern to human health. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
Nonoxynol-9	26571-11-9	102	1	Emulsifier	Acute: Fish: 96 h EC50 = 1.3 mg/L (Lepomis macrochirus) Invertebrates: 48 h EC50 = 0.339 mg/L (read across from nonylphenol monoethoxylate, CAS RN 27986-36-3) Algae: 5 d EC50 = 37.4 mg/L (Scenedesmus spollensis), Chronic Fish: 21 d NOEC = 0.048 mg/L (Oncorhynchus mykiss) (read across from nonylphenol monoethoxylate, CAS RN 27986-36-3) Invertebrates: 6 d NOEC = 1.0 mg/L (Daphnia magna) Algae: 96 h NOEC = 8.0 mg/L (Pseudokirchneriella subcapitata)	Based on Acute and Chronic: Very High	No. The chemical is expected to undergo degradation in the environment.	No. The chemical is expected to have low to moderate bioaccumulation potential in aquatic organisms.	Tier 2	The risk was classified as very high based on acute and chronic data. The exposure concentration is above the respective ecotoxicity values. A Tier 2 assessment is required.	1.5E-05	7.8E-08	8.6E-05	1.0E-04	Based on the calculated HQ the chemical is of low concern for workers (refer to individual toxicity profile and risk calculations for further detail).
Sodium Carbonate	497-19-8	157	2	pH Buffer	96-hour LC50 Bluegill sunfish (Lepomis macrochirus) > 300 mg/L 96-hour LC50 to mosquitofish (Gambusia affinis) > 740 mg/L 48-hour EC50 to the invertebrate Ceriodaphnia cf. dubia = 200 to 227 mg/L	Based on acute: Low	N.A (Inorganic)	N.A. (Inorganic)	Tier 1 (MAP)	A Tier 1 Environmental Assessment for this chemical has been conducted by NICNAS which concluded that it was low concern to the environment. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
Sodium erythorbate	6381-77-7	4,001	48	Reducing Agent	96 h LC50: Fish > 100 mg/L 48 h EC50 Daphnia magna = 84 - 100 mg/L 72 h NOEC alga = 20 mg/L	Based on acute: Low	Not readily biodegradable	Not bioaccumulative	Tier 1 (MAP)	A Tier 1 Human Health Assessment for this chemical has been conducted by NICNAS which concluded that this chemical was identified as low concern to human health. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
Formic Acid	64-18-6	409	3	Corrosion Inhibitor	EC/LC50 values between 1 and 100 mg/L Daphnia magna 21-d NOEC for effects on reproduction was 100 mg/L	Based on chronic: Low	No. The chemical is expected to be readily biodegradable.	No. The low log Kow values of -1 and the calculated BCF values of 3.2 show low potential for bioaccumulation.	Tier 1	The risk was classified as low based on acute data. The substance is not classified as PBT. The exposure concentration is below the respective ecotoxicity values. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
Acetic acid	64-19-7	3,000	19	pH Buffer	Acute endpoints: Fish = 75 mg/L, Daphnia EC50 = 32 mg/L Chronic endpoints: Daphnia = 150 mg/L	Based on Acute: Moderate	Readily biodegradable	Not Bio accumulative (Based on log Kow = -0.136)	Tier 1 (MAP)	A Tier 1 Environmental Assessment for this chemical has been conducted by NICNAS which concluded that it was low concern to the environment. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
Hydrotreated light petroleum distillate	64742-47-8	81,241	396	Slurry agent	Lowest acute endpoint for Daphnia = 0.018 mg/L	Based on acute: High	Readily biodegradable	Yes. Based on calculated log BCF values for constituents that range from 2.78 to 4.06, and calculated BCF values of 598 to 11,430 L/kg wet-weight.	Tier 2	The risk was classified as high based on acute data. The exposure concentration is above the respective ecotoxicity values. It is noted that the concentration exceeds theoretical solubility and as such, potential direct exposure to non-aqueous phase liquid (NAPL) is hazardous to human health. Occupational health and safety (OH&S) procedures will be implemented by Tamboran to minimise human health exposure. A Tier 2 assessment is required.	1.4E-04	5.4E-04	7.8E-04	1.3E-03	Based on the calculated HQ the chemical is of low concern for workers (refer to individual toxicity profile and risk calculations for further detail).
2-hydroxy-N,N,N-trimethylethanaminium chloride	67-48-1	135,500	908	Clay swelling control	96-hour fish LC50 value is >100 mg/L 48-hour in vertebrate EC50 is 349 mg/L 72-hour EC50 to Pseudokirchneriella subcapitata is >1,000 mg/L 21-day Daphnia NOEC value is 30.2 mg/L	Based on Chronic: Low	Choline chloride is readily biodegradable and thus it does not meet the screening criteria for persistence.	Not Bioaccumulative (based on a measured log Kow of -3.77 and a calculated BCF of 0.59).	Tier 1 (MAP)	A Tier 1 Human Health Assessment for this chemical has been conducted by NICNAS which concluded that this chemical was identified as low concern to human health. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
[redacted]	[redacted]	584	3	Improve surface and interfacial tension	Acute: Fish: 96 hr LL50 was >1.6 mg/L Invertebrates: 48 hr LL50 was 25 mg/L Algae: 72 hr EL50 was 7.8 mg/L	Based on Acute: High	No. The chemical is predicted to be readily biodegradable.	No. The the chemical does not meet the screening criteria for bioaccumulation.	Tier 1	This chemical has been listed as a chemical unlikely to require further regulation to manage risks to health by AICIS. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
[redacted]	[redacted]	2,044	12	Improve surface and interfacial tension	Acute: Fish: 96 hr LL50 was >1.6 mg/L Invertebrates: 48 hr LL50 was 25 mg/L Algae: 72 hr EL50 was 7.8 mg/L	Based on Acute: High	No. The chemical is predicted to be readily biodegradable.	No. The the chemical does not meet the screening criteria for bioaccumulation.	Tier 1	This chemical has been listed as a chemical unlikely to require further regulation to manage risks to health by AICIS. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
[redacted]	[redacted]	681	4	Improve surface and interfacial tension	Acute: Fish: 96 hr LL50 was >1.6 mg/L Invertebrates: 48 hr LL50 was 25 mg/L Algae: 72 hr EL50 was 7.8 mg/L	Based on Acute: High	No. The chemical is predicted to be readily biodegradable.	No. The the chemical does not meet the screening criteria for bioaccumulation.	Tier 1	This chemical has been listed as a chemical unlikely to require further regulation to manage risks to health by AICIS. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
[redacted]	[redacted]	15,184	98	Surfactant	Acute: For invertebrates the LC50 (48 h) for Ceriodaphnia confonma dubia was 4.53 mg/L For algae, the EC50 (72 h) was determined to be 1.97 mg/L The LC50 (96 h) for zebra fish (Danio rerio) resulted in 4.2 mg/L Chronic result within a 21-d reproduction study is available with a NOEC of 2.42 mg/L for Daphnia magna The NOEC for algae was 1.2 mg/L	Based on Acute: High	No. The substances of this category are readily biodegradable.	No. The NOEC from the chronic aquatic toxicity data on the substance is >5.01 mg/L, hence does not meet the screening criteria for toxicity.	Tier 2	The risk was classified as high based on acute data. The exposure concentration is above the respective ecotoxicity values. A Tier 2 assessment is required.	3.6E-04	5.8E-04	2.0E-03	2.9E-03	Based on the calculated HQ the chemical is of low concern for workers (refer to individual toxicity profile and risk calculations for further detail).
Alkyl Pyridines Quat	68909-18-2	256	2	Corrosion inhibitor	The 96 hour LC50 to the sheepshead minnow, Cyprinodon variegatus, in synthetic seawater is 14.1 mg/L. The 48 hour EC50 to Daphnia magna, in freshwater is 3.1 mg/L. The 48 hour EC50 to Daphnia magna, in marine water is 2.85 mg/L. The 72 hour EC50 to the freshwater green algae was determined. The EC50 (growth rate) was found to be 0.47 mg/L and the NOEC (growth rate) was 0.02 mg/L. The EC50/LC50 for microorganisms is117 mg/L and the NOEC for microorganisms is 6.1 mg/L.	Based on Acute: Very High	No. Short term seawater biodegradation showed limited degradation and assessment on the starting materials suggest ultimate biodegradation	No. The Log Kow is ≤ 3.93 at 25 °C and pH 1.1 – 2 which does not meet the screening criteria for bioaccumulation.	Tier 1: Acute toxicity only (corrosive); No evidence of systemic toxicity.	The risk was classified as very high based on acute data. The substance is not classified as PBT. It is noted that the substance is a corrosive substance for which dermal absorption is considered likely to be very low. The effects of dermal exposure will be dominated by those at the site of contact (i.e. local effects) and systemic toxicity is considered to be unlikely. As such OH&S procedures implemented by Tamboran will minimise human health exposure. Management of this chemical is addressed in the EMP to prevent accidental release. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
1octridecanol, ethoxylated	69011-36-5	11,483	63	Emulsifier	Acute toxicity: Fish: LL50 (96h) > 1.1 mg/L (geom. mean measured, OECD 203) Aquatic invertebrates: EL50 (48h): 0.544 mg/L (geom. mean measured, OECD 202) Algae: ErC50 (72h): 3.4 mg/L (meas. arith. mean, OECD 201) Chronic toxicity: Fish: no data available Aquatic invertebrates: NOEC (21 d): 0.218 mg/L (TWA, OECD 211) Algae: ErC10 (72h): 1.33 mg/L (meas. arith. mean, EU method C.3)	Based on Acute: Very High	No. These chemicals were found to be readily biodegradable.	No. Bioaccumulation in organisms is expected to be negligible, due to biotransformation and excretion of alcohol ethoxylates.	Tier 2	The risk was classified as very high based on acute data. The exposure concentration is above the respective ecotoxicity values. A Tier 2 assessment is required.	4.5E-04	9.4E-07	2.5E-03	2.9E-03	Based on the calculated HQ the chemical is of low concern for workers (refer to individual toxicity profile and risk calculations for further detail).
Hydrochloric acid	7647-01-0	152,402	1,070	Mineral acid	Algae = 0.492 mg/L Daphnia = 0.492 mg/L Fish = 4.92 mg/L Daphnia (chronic) = 62 mg/L	Based on Chronic: Low	N.A (Inorganic)	N.A. (Inorganic)	Tier 1	The risk was classified as low based on chronic data. The substance is not classified as PBT. Management of this chemical is addressed in the EMP to prevent accidental release. OH&S procedures implemented by Tamboran will minimise human health exposure. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
Diammonium peroxidisulphate	7727-54-0	256	3	Oxidizing viscosity breaker	96-hr LC50 Oncorhynchus - 76.3 mg/L -48-hr EC50 Daphnia magna, - 120 mg/L -72-hr EC10 Pheadactylum tricornutum - 320 mg/L Acute Aquatic - Invertebrate Daphnia magna reproduction test - NOEC of 20.8 mg/L	Based on acute: Moderate	No. Not applicable, inorganic salt, ionic species ubiquitous in environment	No. Not applicable, inorganic salt, ionic species ubiquitous in environment.	Tier 1	The risk was classified as moderate based on acute data. The substance is inorganic and ubiquitous in the environment. The exposure concentration is below the respective ecotoxicity values. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
Guar gum	9000-30-0	12,778	78	Viscosifier	Lowest measured ecotoxicity endpoint for fish was reported to be 218 mg/L.	Based on Acute: Low	Guar gum is a naturally occurring polysaccharide which would be expected to readily biodegrade. Thus, it is not expected to meet the screening criteria for persistence.	Not Bioaccumulative based on the molecular weight of guar gum (ranges from 200,000 to 300,000 daltons), and it is also water soluble.	Tier 1 (MAP)	A Tier 1 Human Health Assessment for this chemical has been conducted by NICNAS which concluded that this chemical was identified as low concern to human health. A Tier 2 assessment is not required.	NA	NA	NA	NA	NA
Didecyldimethylammonium Chloride	7173-51-5	3,871	21	Biocide	Acute: Fish: 96 h LC50 = 0.19 mg/L, Lepomis macrochirus (Bluegill) Invertebrates: 48 h LC50 = 0.016 mg/L, Daphnia magna Algae: 96 h EC50 = 0.014 mg/L, Pseudokirchneriella subcapitata (Green algae) Chronic: Invertebrates: 21 d NOEC = 0.125 mg/L, Daphnia magna Algae: 72 h NOEC = 0.06 mg/L, Pseudokirchneriella subcapitata (Green algae)	Based on Acute and Chronic: Very High	No. Based on biodegradation studies, this chemical is categorised as Not Persistent.	No. Based on the available measured bioconcentration data, all chemicals in this group are categorised as Not Bioaccumulative.	Tier 2	The risk was classified as very high based on acute and chronic data. The exposure concentration is above the respective ecotoxicity values. A Tier 2 assessment is required.	7.2E-04	1.6E-05	4.0E-03	4.8E-03	Based on the calculated HQ the chemical is of low concern for workers (refer to individual toxicity profile and risk calculations for further detail).
Benzalkonium Chloride	8001-54-5	3,871	23	Biocide	Acute toxicity: Oncorhynchus mykiss (Rainbow trout) 96 h LC50 = 0.064 mg/L Pimephales promelas (Fathead minnow) 96 h LC50 = 0.28 mg/L Daphnia magna (Water flea) 48 h EC50 = 0.037 mg/L Daphnia magna (Water flea) 48 h EC50 = 0.0059 mg/L Chlorella pyrenoidosa (Green algae) 96 h EC50 = 0.67 mg/L Scenedesmus pannonicus (Green algae) 96 h EC50 = 0.085 mg/L Chronic toxicity: Pimephales promelas (Fathead minnow) 34 d NOAEC = 0.032 mg/L Daphnia magna (Water flea) 21 d NOEC = 0.00415 mg/L	Based on Acute and Chronic: Very High	No. The chemical is expected to be biodegradable.	No. The chemical is expected to have low bioaccumulation potential in aquatic organisms.	Tier 2	The risk was classified as very high based on acute and chronic data. The exposure concentration is above the respective ecotoxicity values. A Tier 2 assessment is required.	8.1E-04	1.7E-06	4.5E-03	6.3E-03	Based on the calculated HQ the chemical is of low concern for workers (refer to individual toxicity profile and risk calculations for further detail).
[redacted]	[redacted]	17,228	95	Emulsifier	96 h LC50, Oncorhynchus mykiss = 5 - 7 mg/L 30 d Lepomis macrochirus, NOEC = 0.11 – 0.33 mg/L. 48 h EC50 Daphnia magna = 2.5 mg/L. 21 d NOEC Daphnia magna = 0.77 – 1.75 mg/L. 96 h EC50 (green algae) = 1.4 mg/L. EC50 (3 h) for microorganisms = 140 mg/L	Based on Chronic and Acute: High	Readily biodegradable	Not bioaccumulative	Tier 2	The risk was classified as high based on chronic and acute data. The exposure concentration is above the respective ecotoxicity values. A Tier 2 assessment is required.	6.7E-04	2.4E-04	3.7E-03	4.6E-03	Based on the calculated HQ the chemical is of low concern for workers (refer to individual toxicity profile and risk calculations for further detail).
													Total Risk	**3.8E-02**	The chronic health risks associated with potential exposure to COPC identified in flowback water, where the Stimulation Fluid Recipe is used and assuming 100% mass recovery are considered to be acceptable.

Notes
* Chemical composition and information not provided to AECOM due to proprietary controls by the chemical manufacturer
Tier 1 (MAP) - Chemical identified as of low concern for human health, as published in the National Assessment of Chemicals Associated with Coal Seam Gas Extraction in Australia (NICNAS 2017).
1 - Please refer to the individual toxicity profiles for further detail.
2 - Toxicity assessed using NT (2021)
3 - Biodegradation assessed as per NT (2021) and DoEE (2017)
BCF – Bioconcentration Factor
N.A – Not Applicable
NICNAS 2017 - National Assessment of Chemicals Associated with Coal Seam Gas Extraction in Australia
DoEE 2017 - Draft Risk Assessment Guidance Manual: For Chemicals Associated with Coal Seam Gas Extraction, Australian Government, Department of Energy
NT 2021 - Northern Territory Government, Department of Environment, Parks and Water Security, Environment Management Plan Content Guideline, 2021

Toxicity and Dermal Absorption Parameters

C = calculated from chronic value, Ch = chronic value adopted

CAS#	Chemical	Oral/Dermal Exposures				Inhalation Exposures								
		Threshold Chronic TDI or RfD (mg/kg/day)		Dermal Permeability (cm/hr)	Reference	Inhalation Unit Risk $(ug/m^3)^{-1}$	Non-Threshold Slope Factor $(mg/kg/day)^{-1}$		Threshold Chronic TC or RfC (mg/m^3)		NOAEC or LOAEC (mg/m^3)	NOAEL or LOAEL (mg/kg bw/d)	UF	Reference
	COPC in Hydraulic Fracturing Fluid Injected into Well													
10043-35-3	Boric acid	0.55	D	9.14E-04	EPI				1.925	converted from RFD		55	100	REACH ECHA
104-55-2	Cinnamaldehyde	2	D	5.20E-03	EPI				7	converted from RFD		200	100	NICNAS (2017)
111-30-8	Gluteraldehyde	0.04	D	3.25E-04	EPI				0.14	converted from RFD		4	100	NICNAS (2017)
127087-87-0	Polyethylene Glycol Trimethylnonyl Ether	0.15	D	3.99E-03	EPI				0.525	converted from RFD		15	100	NHMRC (2008)
26571-11-9	Nonoxynol-9	0.15	D	3.99E-03	EPI				0.525	converted from RFD		15	100	NHMRC (2008)
64742-47-8	Hydrotreated light petroleum distillate	10	D	1.96E+00	EPI				35	converted from RFD		1000	100	NICNAS (2017)
69011-36-5	Isotridecanol, ethoxylated	0.5	D	1.67E-03	EPI				1.75	converted from RFD		50	100	AICIS (2019)
[redacted]		0.96	D	1.29E+00	EPI				3.36	converted from RFD		96	100	AICIS (2020)
7173-51-5	Didecyldimethyl ammonium chloride	0.1	D	1.81E-02	EPI				0.35	converted from RFD		10	100	USEPA (2017)
8001-54-5	Benzalkonium Chloride	0.1	D	1.71E-03	EPI				0.35	converted from RFD		10	100	AICIS (2015)
[redacted]		0.5	D	2.87E-01	EPI				1.75	converted from RFD		50	100	AICIS (2019)

Notes:

D - Derived (refer to individual Toxicity Profiles)

* uncertainty factors of 10 each for intra-species variability (variability across the human population) and inter-species variability (variability between responses seen in animals and humans), for sub-chronic exposures

A - No information available. Assumed default value.

References:

AICIS (2019) IMAP, Human Health Tier II Assessment for Ethoxylates of aliphatic alcohols

AICIS (2020) IMAP, Selected anionic surfactants: Human health tier IIassessment

AICIS (2015) IMAP, Human Health Tier II Assessment for Cationic surfactants

EPI - USEPA Estimation Programs Interface (EPI) Suite

NICNAS (2017) - Department of the Environment and Energy 2017 , National assessment of chemicals associatedwith coal seam gas extraction in Australia, prepared by the National Industrial ChemicalsNotification and Assessment Scheme

REACH - ECHA REACH European Chemicals Agency Database: http://apps.echa.europa.eu

NHMRC (2008) Australian Guidelines for Water Recycling, Augmentation of Drinking Water Supplies

Exposure to Chemicals via Incidental Ingestion of Flowback fluid

Chronic Exposures

General Data/ Equations		Units	Exposure Calculations (RME) Ingestion of Flowback Water by Workers	
Exposure Parameters				
Exposure Frequency (EF)		days/year	20	Assume work 5 days per week for 1 month during the fraccing period
Exposure Duration (ED)		years	0.083	Maximum duration of the frac. Works will be complete in one month.
Body Weight (BW)		kg	78	Average male and female adults as per enHealth 2012
Averaging Time - NonThreshold (ATc)		days	25550	USEPA 1989 and CSMS 1996
Averaging Time - Threshold (ATn)		days	30.42	USEPA 1989 and CSMS 1996
Ingestion Rate (IRw)		L/day or L/hr	0.005	Assume Incidental ingestion of 5 ml (1 tsp) of water per day during fraccing.
Bioavailability (B)		-	100%	Assume 100% bioavailability via ingestion of chemicals in water.
Intake Factor =	**IRw*ET*B*EF*ED / BW*AT**	L/kg/day	**4.2E-09** **3.5E-06**	**NonThreshold** **Threshold**

Daily Intake from Water = Concentration in Water x Intake Factor (ref: USEPA 1989)
NonThreshold Risk = Daily Intake from Water for NonThreshold Effects x Slope Factor
Hazard Quotients = (Daily Intake from Water for Threshold Effects/ADI)

Chemical		Toxicity Data: Non-Threshold Slope Factor	Toxicity Data: Chronic Threshold TDI	Toxicity Data: Background Intake (% Chronic TDI)	Toxicity Data: Chronic TDI Allowable for Assessment (TDI-Background)	Concentration in Water	Daily Intake: NonThreshold	Daily Intake: Threshold	Calculated Risk: NonThreshold Risk	Calculated Risk: Chronic Hazard Quotient
		(mg/kg-day)$^{-1}$	(mg/kg/day)		(mg/kg/day)	(mg/L)	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
10043-35-3	Boric acid		5.5E-01		5.5E-01	7.58	3.2E-08	2.7E-05	--	4.8E-05
104-55-2	Cinnamaldehyde		2.0E+00		2.0E+00	2.62	1.1E-08	9.2E-06	--	4.6E-06
111-30-8	Gluteraldehyde		4.0E-02		4.0E-02	25.01	1.0E-07	8.8E-05	--	2.2E-03
127087-87-0	Polyethylene Glycol Trimethylnonyl Ether		1.5E-01		1.5E-01	9.48	4.0E-08	3.3E-05	--	2.2E-04
26571-11-9	Nonoxynol-9		1.5E-01		1.5E-01	0.66	2.8E-09	2.3E-06	--	1.5E-05
64742-47-8	Hydrotreated light petroleum distillate		1.0E+01		1.0E+01	396.07	1.7E-06	1.4E-03	--	1.4E-04
69011-36-5	Isotridecanol, ethoxylated		5.0E-01		5.0E-01	63.47	2.7E-07	2.2E-04	--	4.5E-04
[redacted]			9.6E-01		9.6E-01	97.53	4.1E-07	3.4E-04	--	3.6E-04
7173-51-5	Didecyldimethyl ammonium chloride		1.0E-01		1.0E-01	20.52	8.6E-08	7.2E-05	--	7.2E-04
8001-54-5	Benzalkonium Chloride		1.0E-01		1.0E-01	23.12	9.7E-08	8.1E-05	--	8.1E-04
[redacted]			5.0E-01		5.0E-01	95.23	4.0E-07	3.3E-04	--	6.7E-04
								Total Risk (mixture)		**5.63E-03**

Note:
This scenario is deemed protective of the following scenarios due to the less frequent and short duration of exposures:
- Worker exposure during a spill (i.e.a couple breaks on a tank and releases product onto the worker) or leak scenarios

Dermal Exposure to Chemicals via Contact of Flowback Fluid

Chronic Exposures

General Data/ Equations	Units	Exposure Calculations (RME) Dermal Contact with Flowback Fluid by Workers	
Exposure Parameters			
Exposure Frequency (EF)	days/year	20	Assume work 5 days per week for 1 month during the fraccing period
Exposure Duration (ED)	years	0.083	Maximum duration of the operation. Works will be complete in one month.
Body Weight (BW)	kg	78	Average male and female adults as per enHealth 2012
Averaging Time - NonThreshold (ATc)	days	25550	USEPA 1989 and CSMS 1996
Averaging Time - Threshold (ATn)	days	30.42	USEPA 1989 and CSMS 1996
Event Frequency (EV)	(events/day)	1	
Surface Area (SAw)	cm^2	2300	Hands and forearms exposed (enHealth 2012) Occupational HSE would require long pants and closed shoes on Australian work sites; forearms conservatively included
Event Duration (tevent)	hr/event	1	Assume contact with fraccing fluid for 1 hour per event
Conversion Factor (CF)	L/cm^3	1.E-03	Conversion of units
$CDI_{Der,w} = \frac{DAevent * SA * EV * EF * ED}{365 \frac{days}{year} * AT * BW}$	mg/kg/day	calculated	Chronic Daily Intake via dermal contact with water
$DAevent = Cw * Kp * t_{event} * CF$	mg/cm^2-event	calculated	Dermal absorbed dose per event per unit exposed skin area

Daily Intake from Water = Concentration in Water x Dermal Permeability x Intake Factor (ref: USEPA 1989, 2004)
NonThreshold Risk = Daily Intake from Water for NonThreshold Effects x Slope Factor
Hazard Quotients = (Daily Intake from Water for Threshold Effects/ADI)

	Chemical	Toxicity Data: Non-Threshold Slope Factor	Toxicity Data: Chronic Threshold TDI	Toxicity Data: Background Intake (% chronic TDI)	Toxicity Data: Chronic TDI Allowable for Assessment (TDI-Background)	Dermal Permeability (Kp)	Concentration in Water (Cw)	DAevent	Chronic Daily Intake $CDI_{der,w}$: NonThreshold	Chronic Daily Intake $CDI_{der,w}$: Threshold	Calculated Risk: NonThreshold Risk	Calculated Risk: Chronic Hazard Quotient
		$(mg/kg\text{-}day)^{-1}$	(mg/kg/day)		(mg/kg/day)	(cm/hr)	(mg/L)	mg/cm^2-event	(mg/kg/day)	(mg/kg/day)	(unitless)	(unitless)
10043-35-3	Boric acid		5.5E-01		5.5E-01	9.1E-4	7.58	6.93E-06		3.1E-08	--	5.6E-08
104-55-2	Cinnamaldehyde		2.0E+00		2.0E+00	5.2E-3	2.62	1.36E-05		6.0E-08	--	3.0E-08
111-30-8	Gluteraldehyde		4.0E-02		4.0E-02	3.3E-4	25.01	8.13E-06		3.6E-08	--	9.0E-07
127087-87-0	Polyethylene Glycol Trimethylnonyl Ether		1.5E-01		1.5E-01	4.0E-3	9.48	3.78E-05		1.7E-07	--	1.1E-06
26571-11-9	Nonoxynol-9		1.5E-01		1.5E-01	4.0E-3	0.66	2.63E-06		1.2E-08	--	7.8E-08
64742-47-8	Hydrotreated light petroleum distillate		1.0E+01		1.0E+01	2.0E+0	396.07	7.76E-01		3.4E-03	--	3.4E-04
69011-36-5	Isotridecanol, ethoxylated		5.0E-01		5.0E-01	1.7E-3	63.47	1.06E-04		4.7E-07	--	9.4E-07
[redacted]			9.6E-01		9.6E-01	1.3E+0	97.53	1.26E-01		5.6E-04	--	5.8E-04
7173-51-5	Didecyldimethyl ammonium chloride		1.0E-01		1.0E-01	1.8E-2	20.52	3.71E-04		1.6E-06	--	1.6E-05
8001-54-5	Benzalkonium Chloride		1.0E-01		1.0E-01	1.7E-3	23.12	3.95E-05		1.7E-07	--	1.7E-06
[redacted]			5.0E-01		5.0E-01	2.9E-1	95.23	2.73E-02		1.2E-04	--	2.4E-04
										Total Risk (mixture)		**1.2E-03**

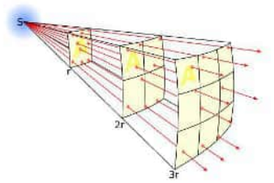
Note:
This scenario is deemed protective of the following scenarios due to the less frequent and short duration of exposures:
- Worker exposure during a spill (i.e.a couple breaks on a tank and releases product onto the worker) or leak scenarios

Aerosol Exposure - Flowback Fluid

The concentration of COPC in aerosol spray was estimated by calculating the concentration for driftable droplets using a mixed box model in which steady state
An emission factor for driftable aerosol was estimated using the algorithm presented below.

Emission Factor for Driftable Aerosol Algorithm

$$Emission\ Factor_{driftable\ aerosol}\left(\frac{L}{m^3}\right) = \frac{Box\ Centre^2(m) \times \left(\frac{Spray\ Vol\left(\frac{L}{hr}\right) \times Aerosol_{driftable}(\%)}{BoxVR\left(\frac{m^3}{hr}\right)}\right)}{BoxDistance^2\ (m)}$$



Aerosol Exposure Modelling Notes:

1) The inhalation of chemicals in mist/aerosol resultant from irrigation activities is dependent upon the concentration in water, the amount of water used per unit time, how close a person stands to the spray generation, how long they are in a position of exposure and the extent of spray drift (determined by the size of the water droplets and speed/direction of the wind). These equations are applicable for non-volatile contaminants that are inhaled.

2) These equations calculate the concentration for driftable droplets using a simple well mixed box model in which steady state air concentrations are calculated. The 'Inverse square law' is then applied to approximate the air concentration at a distance from the virtual air box. This law assumes the further away a receptor is from the spray source, the density of the droplets will decrease. The density of the spray droplets is inversely proportional to the square of the distance from the source.

Parameter	Units	Value	Description
Spray box length	m	3	Assume a 'spray box' of 3 m long.
Spray box width	m	3	Assume a 'spray box' of 3 m wide.
Box Centre	m	1.5	Distance to centre of box is 1.5 m.
$Box_{Distance}$	m	2	Distance the irrigation worker is from the 'spray box'. Assumed a distance of 2 m.
$Aerosol_{driftable}$	unitless	0.2	Proportion of aerosol spray that drifts outside the 'spray box' and available for exposure. Assumed 0.2, based on a droplet size of 400 – 500 µm that falls approximately 0.3 m in less than 10 seconds, with a lateral drift of approximately 3.5 m in a 5 km/hr wind (i.e. a light breeze) (Grisso et al. 2013).
Spray Volume	L/hr	1800.0	1800 L/min, irrigation value adopted from NZ MtE (2011) Appendix 5A.
Wind speed	m/hr	9000	Based on windspeed of 2.5 m/sec
BoxVR	m^3/hr	81000.0	Ventilation rate of spray in the 'spray box'. Assumed to be 81,000 m3/hr based on a wind speed of 9000 m/hr, and a 'spray box' dimension of 3 x 3 m.

CAS	Chemical	Concentration in Water	Generation rate of chemical in volume	Driftable Aerosol Emission Factor
		mg/L	mg/hr	L/m^3
10043-35-3	Boric acid	7.58	2727.674472	2.500000E-03
104-55-2	Cinnamaldehyde	2.62	942.1585052	2.500000E-03
111-30-8	Gluteraldehyde	25.01	9002.028893	2.500000E-03
127087-87-0	Polyethylene Glycol Trimethylnony	9.48	3411.032819	2.500000E-03
26571-11-9	Nonoxynol-9	0.66	237.2014847	2.500000E-03
64742-47-8	Hydrotreated light petroleum distill	396.07	142585.9106	2.500000E-03
69011-36-5	Isotridecanol, ethoxylated	63.47	22849.35882	2.500000E-03
[redacted]		97.53	35110.5936	2.500000E-03
7173-51-5	Didecyldimethyl ammonium chlorid	20.52	7388.457676	2.500000E-03
8001-54-5	Benzalkonium Chloride	23.12	8322.630486	2.500000E-03
[redacted]		95.23	34281.00268	2.500000E-03

Exposure to Chemicals via Inhalation of Mist from the Evaporation Units - Flowback Fluid

Chronic Exposures

General Data/ Equations	Units	Exposure Calculations (RME) Inhalation of Mist by Workers	
Exposure Parameters			
Exposure Frequency (EF)	days/year	240	Exposure for 5 days per week minus 4 weeks holidays
Exposure Duration (ED)	years	1	Maximum duration that the flowback tank will be on-site
Exposure Time (ET)	hr/day	1	Professional judgement for irrigation exposure. Assume worker to be near tank for 1 hours every working day.
Driftable aerosol emission factor (EMF)	L/m3	2.50E-03	Calculated
Aerosol Inhalation Bioavailability (AAF)	unitless	1.0	Assume 100% bioavailability
Averaging Time - Threshold (AT)	years	1.0	USEPA 1989 and CSMS 1996
$ITF_{inh,w,shwr} = \frac{EmF \times AAF \times ET_{iw} \times EF \times ED}{365\ \frac{days}{year} \times 24\ \frac{hours}{day} \times AT}$			

Daily Intake = Concentration in Water x Intake Factor (ref: USEPA 1989)
Hazard Quotients = (Daily Intake from Water for Threshold Effects/ADI)

CAS	Chemical	Groundwater Concentration	Aerosol Inhalation Bioavailability	Driftable Aerosol Emission Factor	RfC (Background Corrected)	Threshold Intake and Risk Calculations: Adult Exposure Factor (threshold)	Adult Exposure Adjusted Air Concentration (threshold)	Hazard Index (Adult)
		mg/L	(unitless)	(L/m^3)	(mg/m^3)	(L/m^3)	(mg/m^3)	(unitless)
10043-35-3	Boric acid	7.6	1.00	2.50E-03	1.93E+00	6.85E-05	5.19E-04	2.7E-04
104-55-2	Cinnamaldehyde	2.6	1.00	2.50E-03	7.00E+00	6.85E-05	1.79E-04	2.6E-05
111-30-8	Gluteraldehyde	25.0	1.00	2.50E-03	1.40E-01	6.85E-05	1.71E-03	1.2E-02
127087-87-0	Polyethylene Glycol Trimethylnonyl Ether	9.5	1.00	2.50E-03	5.25E-01	6.85E-05	6.49E-04	1.2E-03
26571-11-9	Nonoxynol-9	0.7	1.00	2.50E-03	5.25E-01	6.85E-05	4.51E-05	8.6E-05
64742-47-8	Hydrotreated light petroleum distillate	396.1	1.00	2.50E-03	3.50E+01	6.85E-05	2.71E-02	7.8E-04
69011-36-5	Isotridecanol, ethoxylated	63.5	1.00	2.50E-03	1.75E+00	6.85E-05	4.35E-03	2.5E-03
[redacted]		97.5	1.00	2.50E-03	3.36E+00	6.85E-05	6.68E-03	2.0E-03
7173-51-5	Didecyldimethyl ammonium chloride	20.5	1.00	2.50E-03	3.50E-01	6.85E-05	1.41E-03	4.0E-03
8001-54-5	Benzalkonium Chloride	23.1	1.00	2.50E-03	3.50E-01	6.85E-05	1.58E-03	4.5E-03
[redacted]		95.2	1.00	2.50E-03	1.75E+00	6.85E-05	6.52E-03	3.7E-03
							Total Threshold Risk (mixture)	**0.03**

Summary of Risk to Workers - Flowback Fluid
Exposure fo Target Chemicals - Theoretical Data

Receptor/Exposure Pathway	Calculated HI 100% Mass Return
Use of Stimulation Fluid in Hydraulic Fracturing	
Planned Recipe	
Workers	
Ingestion of Chemicals via Incidental Contact with Flowback Water	0.006
Dermal Exposure to Chemicals via Incidental Contact with Flowback Water	0.001
Inhalation of mist from the evaporation units	0.03
Total Risk	**0.04**

Appendix C

Toxicological Profiles

Toxicity Summary - Polyethylene glycol trimethylnonyl ether

Chemical and Physical Properties [1,2]	
CAS number	127087-87-0
Molecular formula	Not applicable. This substance is an unknown or variable-composition polymer. The general formula of nonylphenol ethoxylate (NPE) chemicals 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.
Molecular weight	Not applicable. This substance is an unknow or variable-composition polymer as described above.
Solubility in water	1.104 x 10^{-3} g/L at 25 °C
Density	1.042 kg/L at 20°C
Melting point	Not applicable
Boiling point	188.6 °C at 97.77 kPa
Vapour pressure	4.86 x 10^{-13} kPa at 25 °C
Henrys law constant	No data available.
Explosive potential	Non-explosive
Flammability potential	Non-flammable
Colour/Form	Slightly hazy, colourless liquid
Overview	This chemical is a manufactured NPE. NPEs are primarily used as surfactants in a wide range of cosmetic, domestic and industrial products. This chemical is on the International Fragrance Association (IFRA) transparency list for use in fragrances (IFRA, 2022). It is also listed as an Organisation for Economic Co-operation and Development (OECD) High Production Volume (HPV) chemical, indicating that more than 1000 tonnes of the chemical are produced per year in at least one member country of the OECD. The chemical can be emitted into the environment in treated effluents and biosolids produced by sewage treatment plants.
Environmental Fate [3]	
Soil/Water/Air	This chemical is slightly soluble in water and has low volatility. When released into the environment, long chain NPEs may remain in water due to their high water solubility and low volatility, whereas shorter chain NPEs have lower water solubility and can adsorb to solids such as sediments and sludge. NPEs are susceptible to substantial biodegradation in the environment. Under aerobic conditions, rapid biodegradation forms nonylphenol ethoxyacetates, and under anaerobic conditions, nonylphenols (NPs) and shorter-chain NPE degradants are formed. While some degradants are much more persistent relative to their parent chemicals, they are expected to be ultimately biodegradable in the environment. The chemical is not expected to undergo long-range transport based on biodegradability, low volatility, and adsorption to soil and sediment. Although soluble in water, NPEs have a relatively short primary half-life in water.
Human Health Toxicity Summary[1,2,5]	
Chronic Repeated Dose Toxicity	Based on the available data from repeated dose oral toxicity studies undertaken in rats, mice and beagle dogs these chemicals are not considered to cause serious damage to health following repeated oral exposure. No data are available for NPEs from repeated dermal or inhalation exposure.
Carcinogenicity	Based on the available data from carcinogenicity studies in rats and mice exposed to NPEs orally and intravaginally, NPEs are not considered to be carcinogenic.
Mutagenicity/ Genotoxicity	Based on the available *in vitro* genotoxicity data, NPEs are not considered to be genotoxic, with negative results obtained for NPEs in several *in vitro* assays. No *in vivo* genotoxicity data are available for NPEs.

Reproductive Toxicity / Developmental Toxicity/ Teratogenicity	Studies are available only for NPE-9, NPE-10, NPE-30. No data are available for other NPEs. 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.
Acute Toxicity	The acute oral toxicity of NPEs and OPEs could range from low to moderate. The toxicity of NPEs and OPEs is considered to increase with decreasing EO units (or chain length) (Health Canada, 2002). Based on the available data (the median lethal dose (LD50) = 1300 or 1310 mg/kg bw in rats for some NPEs, and 691–1600 in rats for some OPEs.
Irritation	This chemical can cause skin irritation and serious eye irritation. Moderate to severe skin and eye irritation has been reported in animal studies using rabbits and rats. Slight to mild skin irritation has been observed in humans.
Sensitisation	Based on the available data, NPEs are generally not considered to have skin sensitisation potential, however, there is evidence of mild contact dermatitis in human patch tests with short-chain NPEs.
Health Effects Summary	The critical health effects for risk characterisation are skin and eye irritation. NPEs could also cause systemic acute effects from oral exposure. However, these health effects are applicable mainly for short chain length NPEs and the effects could reduce with increasing chain lengths. Those with ≥30 EO chains are reported to be generally non-toxic. While nonoxynol-9 is toxic to reproduction and this is expected to also apply to related NPEs, the effects appear to be specific to direct spermicidal use, which is not relevant to industrial uses of the chemicals. The NPEs biodegrade to NPs in the environment and some products containing NPEs can also contain residual amounts of NPs. Therefore, critical health effects of NPs could also be applicable for risk characterisation under those situations, particularly following secondary exposure from environmental sources.
Key Study/Critical Effect for Screening Criteria	Based on the NHMRC (2008) Australian Guidelines for Water Recycling, Augmentation of Drinking Water Supplies, a guideline value of 500 µg/L has been derived for nonylphenols, using a NOEL of 15 mg/kg bw/day and an uncertainty factor of 100.
Ecological Toxicity [2,3]	
Aquatic Toxicity	Read across from CAS 9016-45-9 (Polyoxyethylene Nonylphenol Ether) Acute: Fish: 96 h EC50 = 1.3 mg/L (Lepomis macrochirus) Invertebrates: 48 h LC50 = 1.821 mg/L (QSAR) Algae: 5 d EC50 = 37.4 mg/L (Scenedesmus opoliensis), Gallery worm: 48 h LC50 = 3.26 mg/L (Capitella capitate) Chronic: Fish: 21 d NOEC = 0.048 mg/L (Oncorhynchus mykiss) (read across from nonylphenol monoethoxylate) Invertebrates: 6 d NOEC = 1.0 mg/L (Daphnia magna) Algae: 96 h NOEC = 8.0 mg/L (Pseudokirchneriella subcapitata)
Determination of PNEC aquatic	Fish are the most sensitive taxon to toxic effects of the chemicals in this group, based on the available information. The $PNEC_{aqua}$ derived for the most toxic chemical in this group, nonylphenol monoethoxylate, is 0.48 µg/L based on the 21 d NOEC of 0.048 mg/L for Oncorhynchus mykiss. The laboratory chronic toxicity value for this fish species was divided by an assessment factor of 100 to account for both interspecies variation and the relative lack of chronic aquatic toxicity data available for chemicals in this group.

<table>
<tr><th colspan="2">Current Regulatory Controls[4]</th></tr>
<tr><td>Listed as a Chemical of Concern on International Databases</td><td>
<table>
<tr><th>International Database</th><th>Listed?</th></tr>
<tr><td>European REACH regulation Substances of very high concern (SVHCs) according to Annex XV
https://echa.europa.eu/candidate-list-table</td><td>Yes</td></tr>
<tr><td>International Agency for Research on Cancer (IARC) as a Group 1, 2A or 2B carcinogen
https://monographs.iarc.who.int/list-of-classifications</td><td>No</td></tr>
<tr><td>National Toxicology Program (NTP) Report on Carcinogens (RoC)
https://ntp.niehs.nih.gov/whatwestudy/assessments/cancer/roc/index.html</td><td>No</td></tr>
<tr><td>US EPA Integrated Risk Information System (IRIS) as carcinogenic to humans, or likely / probable / possibly carcinogenic to humans
EU list chemicals with endocrine disruption listed in Category 1 or Category 2
https://www.epa.gov/iris</td><td>No</td></tr>
<tr><td>United States Endocrine Disrupter Screening Program
https://www.epa.gov/endocrine-disruption/endocrine-disruptor-screening-program-tier-1-screening-determinations-and</td><td>No</td></tr>
<tr><td>Agency for Toxic Substances and Disease Registry (ATSDR) as a neurotoxin
https://wwwn.cdc.gov/TSP/index.aspx?sysid=18</td><td>No</td></tr>
<tr><td>Montreal Protocol
https://www.dcceew.gov.au/environment/protection/ozone/montreal-protocol</td><td>No</td></tr>
<tr><td>Rotterdam Convention
http://www.pic.int/TheConvention/Chemicals/AnnexIIIChemicals</td><td>No</td></tr>
<tr><td>Stockholm Convention
http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx</td><td>No</td></tr>
</table>
</td></tr>
<tr><td>Australian Hazard Classification</td><td>This chemical is classified as hazardous in Safe Work Australia HCIS.
• Hazard categories include:
- Acute toxicity – Category 4
- Skin irritation – Category 2
- Eye irritation – Category 2A
• Hazard statements include:
- H302 (Harmful if swallowed)
- H315 (Causes skin irritation)
- H319 (Causes serious eye irritation)</td></tr>
<tr><td>Australian Occupational Exposure Standards</td><td>No Australian occupational exposure standards are provided by Safe Work Australia HCIS for this chemical.</td></tr>
<tr><td>International Occupational Exposure Standards</td><td>No exposure standards provided in NIOSH.</td></tr>
<tr><td>Australian Food Standards</td><td>No Australian food standards were identified in FSANZ</td></tr>
<tr><td>Australian Drinking Water Guidelines</td><td>No aesthetic or health-related guidance values were identified for CAS 127087-87-0 in the National Health and Medical Research Council (NHMRC) Australian Drinking Water Guidelines (NHMRC, 2022).

However, a guideline value of 500 µg/L has been derived for drinking water augmentation for nonylphenols.</td></tr>
<tr><td>Aquatic Toxicity Guidelines</td><td>No Australian guidelines available.</td></tr>
</table>

PBT Assessment [3]	
P/vP Criteria fulfilled?	No. Based on results obtained from biodegradation studies, this chemical is categorised as Not Persistent.
B/vB criteria fulfilled?	No. Based on the available measured bioconcentration data, this chemical is categorised as Not Bioaccumulative.
T criteria fulfilled?	No. Based on available acute ecotoxicity values above 1 mg/L and chronic ecotoxicity values above 0.1 mg/L, this chemical is categorised as Not Toxic.
Overall conclusion	Not a PBT substance.

Notes: *HCIS – Hazardous Chemical Information System; NIOSH – National Institute for Occupational Safety and Health; FSANZ – Food Standards Australia New Zealand; NHMRC (2022) – National Health and Medical research Council, Australian Drinking Water Guidelines 6, 2011 (Version 3.8, Updated September 2022)*

References

1. Australian Industrial Chemicals Introduction Scheme (AICIS) online database. IMAP, Human Health Tier II Assessment for Nonylphenol and octylphenol ethoxylates and related compounds. Retrieved 2024: https://cdnservices.industrialchemicals.gov.au/statements/IMAP_1844%20-%20IMAP%20Assessment%20-%2008%20March%202019.pdf.
2. ECHA, https://echa.europa.eu/registration-dossier/-/registered-dossier/19064
3. Australian Industrial Chemicals Introduction Scheme (AICIS) online database. IMAP, Environment Tier II Assessment for Nonylphenol ethoxylates and their sulfate and phosphate esters. Retrieved 2024: https://cdnservices.industrialchemicals.gov.au/statements/IMAP_48415%20-%20IMAP%20Assessment%20-%2025%20November%202016.pdf.
4. HCIS, Hazardous Chemical Information System, Safe Work Australia, Retrieved: http://hcis.safeworkaustralia.gov.au/HazardousChemical
5. NHMRC (2008) Australian Guidelines for Water Recycling, Augmentation of Drinking Water Supplies, May 2008

Toxicity Summary - N-Benzyl-Alkylpyridinium Chloride

Chemical and Physical Properties[1]	
CAS number	68909-18-2
Molecular formula	UVCB
Molecular weight	UVCB
Solubility in water	100 g/L at 30 °C
Density	1.104 at 20 °C
Melting point	-57.27 °C
Boiling point	116.34 °C
Vapour pressure	2 hPa at 20 °C
Henrys law constant	No data available.
Explosive potential	Non-explosive
Flammability potential	No data available.
Colour/Form	Liquid
Overview	The substance is mixture of alkyl pyridine quaternary ammonium salts. Due to the nature of the material used to produce N-Benzyl-Alkylpyridinium Chloride, the test substance is a complex multi component (UVCB) mixture.
Environmental Fate [1]	
Soil/Water/Air	The substance is a UVCB with mixed solubility characteristics. To determine the adsorption / desorption of N-Benzyl-Alkylpyridinium Chloride, a screening test conducted in accordance with OECD 121 indicated that due to its multi component nature this chemical displayed a range of Log Koc values from <1.25 to 5.40. Similarly, N-Benzyl-Alkylpyridinium Chloride reported a Log Kow value of 3 at 25 °C. Whilst there is some potential for adsorption on the basis of these data, it is considered that the significant proportion of this chemical is mobile and water soluble.
Human Health Toxicity Summary[1]	
Chronic Repeated Dose Toxicity	No repeated dose toxicity data are available for the substance. Due to the corrosive nature of the substance and its likely low systemic absorption, it is considered that the effects of the substance are very likely to be limited to the site of contact. The substance is corrosive and (based on its physicochemical properties and read-across from similar quaternary ammonium compounds) is considered likely to be poorly systemically absorbed following oral administration. It is therefore very likely that the effects of the repeated oral administration in an animal study will be largely local (due to irritation/corrosion at the site of contact), with little or no systemic effects other than those secondary to the effects of the substance on the gastrointestinal tract.
Carcinogenicity	No data available.
Mutagenicity/ Genotoxicity	The results of an Ames test, a mouse lymphoma assay and a human lymphocyte micronucleus assay are all negative.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	No data are available, however reproductive and developmental toxicity are not predicted based on read across data.
Acute Toxicity	No acute toxicity data are available. The effects of acute exposure to the substance will be dominated by local irritation/corrosion at the site of contact and significant systemic toxicity is not predicted due to the likely poor absorption of the substance.
Irritation	No studies of skin or eye irritation were available as the substance is considered to be corrosive based on its low pH.

Sensitisation	No studies of skin sensitisation were available. There are no reports of skin sensitisation in workers potentially exposed to the substance.
Health Effects Summary	N-Benzyl-Alkylpyridinium Chloride is a corrosive substance for which dermal absorption is considered likely to be very low. The effects of dermal exposure will be dominated by those at the site of contact (i.e. local effects) and systemic toxicity is considered to be unlikely.
Key Study/Critical Effect for Screening Criteria	The critical health effects for risk characterisation are local effects (corrosivity) only.
Ecological Toxicity[1]	
Aquatic Toxicity	The 96 hour LC50 to the sheepshead minnow, Cyprinodon variegatus, in synthetic seawater is 14.1 mg/L. The 48 hour EC50 to Daphnia magna, in freshwater is 3.1 mg/L. The 48 hour LC50 to Daphnia magna, in marine water is 2.85 mg/L. The acute toxicity to freshwater green algae was determined. The EC50 (growth rate) was found to be 0.47 mg/L whilst the NOEC (growth rate) was 0.02 mg/L. The EC50/LC50 for microorganisms is117 mg/L and the NOEC for microorganisms is 6.1 mg/L.
Determination of PNEC aquatic	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 NOEC of 0.47 mg/L for algae, resulting in a PNECaquatic of 0.00047 mg/L.
Current Regulatory Controls	
Australian Hazard Classification	No data available.
Australian Occupational Exposure Standards	No data available.
International Occupational Exposure Standards	No data available.
Australian Food Standards	No data available.
Australian Drinking Water Guidelines	No data available.
Aquatic Toxicity Guidelines	No data available.
PBT Assessment[1]	
P/vP Criteria fulfilled?	Potentially. Considered likely to be inherently biodegradable
B/vB criteria fulfilled?	No. The Log Kow for the substance was 3 (<4). Thus, the substance does not meet the screening criteria for bioaccumulation.
T criteria fulfilled?	No. The NOEC from the acute aquatic toxicity data are >0.01 mg/L, hence does not meet the screening criteria for toxicity.
Overall conclusion	Not PBT

References

1. ECHA REACH, Pyridinium, 1-(phenylmethyl)-, ethyl methyl derivs., chlorides, Retrieved 2024: https://echa.europa.eu/brief-profile/-/briefprofile/100.066.067.

Toxicity Summary - Alcohols C16-18, ethoxylated

Chemical and Physical Properties[1,2]	
CAS number	69011-36-5 (assessed as part of a group of structurally related alcohol ethoxylates)
Molecular formula	UVCB
Molecular weight	UVCB
Solubility in water	56 mg/L at 20 °C
Density	0.907 g/cm^3 at 20 °C
Melting point	-11.6 °C at 101 kPa
Boiling point	280 °C at 101 kPa
Vapour pressure	0.007 Pa at 20 °C
Henrys law constant	No data available.
Explosive potential	Non explosives
Flammability potential	Not classified
Colour/Form	Liquid
Overview	The AEs in this assessment are structurally related, where the hydrophilic ethylene oxide (EO) chain is attached via an ether linkage to the hydrophobic aliphatic alcohol chain (C =6). The alkyl chain can be linear, branched, saturated or unsaturated in the AE group. Ethoxylated shorter chain alcohols (C <6) do not show the same degree of surface activity compared with longer chains, and hence they are not included in this assessment. A generic structural formula of the AE is shown below: H–(CH2)x–y–(OCH2CH2)n–OH where n = average number of ethylene oxide (EO) units x–y = range of carbon units (C =6) A simpler notation of 'Cx–yEOn' will be used to represent the corresponding AEs in this assessment. Generally, increasing the carbon chain length increases lipophilicity, whereas increasing alkoxylation increases hydrophilicity of the chemical. These trends are consistent across the linear, branched, saturated or unsaturated AEs of varying alkyl chain lengths and ethoxylation degrees (Lindner, 2010). It was demonstrated that branching of the AEs had a relatively minor impact on calculated partition coefficients (Kow), and hence their biological properties (Lindner, 2010). Further, for unsaturated AEs, as the point of unsaturation is generally remote from the carbon where the EO chain is attached, they are expected to have similar physiochemical properties to saturated AEs. The AEs in this assessment have been shown to have similarities or trends in their toxicokinetic and toxicological profiles, although the alkyl chain length (whether linear, branched, saturated or unsaturated) and ethoxylation degree vary (see Health Hazard Information section). For this AE group, SARs were reported between the degree of ethoxylation and the acute toxicity (direct) and skin irritation (inverse). On the basis of the analogue and chain-length category approach (i.e. by considering similarities and trends in molecular structure, physiochemical properties (Kow), uses, and hazard profiles), the AEs in this assessment are qualified to be assessed as a group. Based on such trend analyses, the available datasets for AEs ranging from C6–C18 and EO3–EO12 were considered

	representative of the AE category for filling data gaps (HERA, 2009; Lindner, 2010). Available data for any AEs will be applicable to group members where data are incomplete or unavailable, such as for ethoxylates of coco, tallow, and C >20 alcohols. Overall, AEs are not expected to be systemically toxic, although some short chain ethylene glycol ethers, e.g. methyl and ethyl homologues are of concern for a range of adverse health effects. They include skin and eye irritation, liver and kidney damage, bone marrow and central nervous system (CNS) depression, testicular atrophy, developmental toxicity, and immunotoxicity. For higher propyl and butyl homologues, the toxicity involves haemolysis (anaemia) with secondary effects relating to haemosiderin accumulation in the spleen, liver and kidney, and compensatory haematopoiesis in the bone marrow. Systemic toxicity was shown to decrease with increasing alkyl chain lengths and/or alkoxylation degrees (ECETOC, 2005; US EPA, 2010). The chemicals ethylene glycol hexyl ether (with a longer alkyl chain length, CAS No. 112-25-4) and diethylene glycol butyl ether (with a higher ethoxylation degree, CAS No. 112-34-5) have no evidence of systemic effects including haemolysis (ECETOC, 2005; NICNASc). Commercially available AEs are mixtures of homologues of varying carbon chain lengths and it is possible that some of the chemicals with an average alkyl chain length C =6 may also contain shorter alkyl chains C <6. It is not practical to quantify the proportion of shorter C <6 chain lengths present in such chemicals, or these shorter chain lengths may not be present at all. The available data suggest a lack of systemic toxicity for the AE chemicals with potential short alkyl chain presence; therefore, the toxicity of the chemicals in this assessment is unlikely to be significantly affected by the presence of shorter chain alkyl groups.
Environmental Fate[2]	
Soil/Water/Air	The substance Isotridecanol, ethoxylated, < 2.5 EO (CAS 69011-36-5) is considered to be readily biodegradable. Alcohol ethoxylates, like Isotridecanol, ethoxylated, will be rapidly mineralised in the environment and thus abiotic degradation by hydrolysis is not a relevant degradation pathway for the substance. Abiotic degradation in water, soil, sediment and air is generally not expected because of the chemical structures of alcohol ethoxylates. The adsorption potential of alcohol ethoxylates is depends on the properties of the AE substance. Properties like chain length of the alcohol and level of ethoxylation drive the adsorption potential, but it also depends on the properties of the soil, sediment or suspended solids to which the substance adsorbs. The log Koc values estimated for Isotridecanol, ethoxylated, < 2.5 EO (CAS 69011-36-5) range from 2.532 to 3.263 when calculated with the log Kow based method. The log Koc range calculated by the MCI based method is 2.376 – 2.645. The available QSAR calculations demonstrate a decreasing potential for adsorption potential with increasing level of ethoxylation. Experimentally determined BCF-values given for pure homologues and summarized in the publication of Tolls et al. (2000) are used as read-across data for the endpoint bioaccumulation in water. It can be stated that bioaccumulation of alcohol ethoxylates is regarded to be negligible as the surfactants will be rapidly metabolised.
Human Health Toxicity Summary[1]	
Chronic Repeated Dose Toxicity	Based on the available data, the chemicals in this group are not expected to cause serious damage to health (apart from local effects) from repeated oral and dermal exposure. In several 90-day feeding studies in rats (similar to OECD TG 408), the reported NOAELs were between 50 and 700 mg/kg bw/day for group members (covering the range of C9–C18 and EO5–EO10). Effects observed at higher concentrations included reduced mean body weights and increases in relative liver, kidney and heart weights (SCCS, 2007; HERA 2009; CIR, 2012). Similar effects were seen in longer-term 2-year feeding studies in rats. The NOAEL for the AEs CAS No. 66455-14-9 (C12–13EO6.5 group member) and CAS No.

	68951-67-7 (C14–15EO7 not listed on the Inventory) were between 50 and 190 (females) mg/kg bw/day (HERA, 2009; CIR, 2012). Repeated oral or inhalation exposure to certain short chain ethylene glycol ethers (EGEs), such as 2-butoxyethanol (ethylene glycol butyl ether, EGBE, CAS No. 111-76- 2) and its acetate (EGBEA, CAS No. 112-07-2), may cause haemolytic effects in rodents and effects on the liver, spleen and kidney. However, humans appear to be the least sensitive species for haemolytic effects (NICNAS, 1996; NICNASc; OECD, 2004; ECETOC, 2005). The AEs in this assessment are not expected to share these mechanisms of toxicity. Therefore, exposure to these AEs is not expected to cause haemolysis and associated organ toxicity in humans. In a well-reported OECD TG 411 (Subchronic 90-day Dermal Toxicity) study, Fischer rats were exposed to C9–11EO6 (CAS No. 68439-46-3) at 1, 10 or 25 % concentrations, 3 days/week. The application site was shaved and not covered. Dry, flaky skin and irritation (epidermal thickening with hyperkeratosis) were observed at >10 %. Relative kidney weights without histological lesions increased in both sexes at 25 %. The NOAEL was established at 10 %, equivalent to 80 mg/kg bw/day (HERA, 2009; CIR, 2012). In an 18-month study, C12–13EO6.5 was applied to the back of Swiss mice 3 days/week. There were no treatment-related systemic lesions at up to 270 mg/kg bw/day. No further study information was available (HERA, 2009).
Carcinogenicity	Based on the available data, chemicals in this group are not considered carcinogenic. Two AEs, CAS No. 66455-14-9 (C12–13EO6.5, group chemical) and CAS No. 68951-67-7 (C14–15EO7, not listed on the Inventory), were administered at up to 1 % in the diet to rats for 1–2 years. No treatment-related histopathological effect or increased tumour incidence were observed (HERA, 2009; CIR, 2012). There was no treatment-related lesions in mice, following 18-month dermal application of C12–13EO6.5 (HERA, 2009). The AEs are synthesised through processes which may result in 1,4-dioxane as an impurity. This impurity is classified as a Carcinogen—Category 2 (H351 Suspected of causing cancer). There are restrictions on the levels of this chemical in preparations available to consumers in Australia (SUSMP).
Mutagenicity/ Genotoxicity	Based on the data available, the chemicals in this group are not considered mutagenic or genotoxic. A broad spectrum of AEs (covering the range of C7–C22 and EO2–EO20) tested negative in multiple in vitro and in vivo tests (OECD and GLP compliant) for gene mutation and clastogenicity. In vitro, negative results were reported in bacterial reverse mutation tests in Salmonella typhimurium (TA98, TA100, TA102, TA104, TA1535, TA1537 and TA1538) and Escherichia coli (strains WP2 and WP2 uvrA pKM101), with or without metabolic activation. Negative results were also reported in chromosomal aberration tests (Chinese hamster lung V79, Chinese hamster ovary, and rat liver cells) and gene mutation tests (mouse lymphoma cells) (SCCP, 2007; HERA, 2009; CIR, 2012). In vivo, AEs (C12–C15 and EO3–EO9) did not induce chromosomal damage in Chinese hamster or Tunstall Wistar rat bone marrow cells after acute oral doses between 250 and 3400 mg/kg bw (SCCP, 2007; HERA, 2009).
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	Based on the data available, the chemicals of this group are not considered to cause reproductive or developmental toxicity. The oral NOAELs were determined at 250 mg/kg bw/day for reproductive toxicity, and >50 mg/kg bw/day for maternal and developmental toxicity. In a 2-generation study, the chemical C14–15EO7 was administered in the diet of Charles River CD rats (25/sex/group, at doses of 0, 25, 50 or 250 mg/kg bw/day).

	The NOAEL for reproductive toxicity was established as 250 mg/kg bw/day (or 0.5 % in diet), given no treatment related effects on fertility, gestation or viability index at this highest tested dose. The NOAEL for maternal and developmental toxicity was established as 50 mg/kg bw/day, based on reduced maternal and pup body weights and increased relative liver weights in both F1 (males and females) and F2 (males) generations at 250 mg/kg bw/day (HERA 2009; CIR, 2012). In a 2-generation study protocol using a different AE (C12EO6), the NOAEL for reproductive toxicity was set at the highest tested dose of 250 mg/kg bw/day. The NOAELs for parental (F0) and developmental toxicity were also 50 mg/kg bw/day, based on reduced body weight gains in F0 and F1 generations at 250 mg/kg bw/day (HERA, 2009; CIR 2012). In an oral developmental toxicity study, C12EO6 was administered in the diet of female rabbits at doses of 0, 50, 100 or 200 mg/kg bw/day from gestation days 2 to 16. Ataxia and a slight decrease in body weight were observed at =100 mg/kg bw/day. Nine rabbits in the control group and 31 in the treatment groups died during the study (details not available). There were no treatment related effects on corpora lutea, implantations, number of live foetuses and spontaneous abortions. No further information was available on live birth index, pup growth or developmental NOAEL. The NOAEL for maternal toxicity was reported at the lowest dose tested, i.e. 50 mg/kg bw/day (HERA, 2009; CIR, 2012). In a dermal 2-generation study, C9–11EO6 (CAS No. 68439-46-3) was applied to Fischer 344 rats (30/sex/group, at doses of 0, 10, 100 or 250 mg/kg bw/day, 3 times/week except mating periods). No effects were reported on mating, fertility or mean gestational length in both generations. No treatment-related effects on testicular weights or sperm counts were observed. There were no effects on F1 and F2 litter size, number of live pups or sex ratio. The NOAEL for reproductive and developmental toxicity was established as 250 mg/kg bw/day (HERA 2009; CIR, 2012). In 2 other dermal studies, the NOAEL values for developmental and teratogenicity of C12EO4 were reported at >240–300 mg/kg bw/day for rats and rabbits, respectively (HERA, 2009). Although certain short chain EGEs such as 2-ethoxyethanol (ethylene glycol ethyl ether, EGEE, CAS No. 110-80-5) are known reproductive toxicants, the ability of these glycol ethers to cause testicular atrophy decreases with increasing alkyl chain length, with effects not observed with chain lengths =C3 (OECD, 2004; ECETOC, 2005). In addition, no effects on reproductive organs were observed in several repeated dose toxicity studies (refer to the Repeated dose toxicity section above).
Acute Toxicity	Some of the AEs in this group are currently classified with hazard category ‘Acute Toxicity – Category 4’ and hazard statement ‘H302 Harmful if swallowed’ in the HCIS (refer to the Existing Work Health and Safety Controls section). Based on the available animal data and international reviews, the AEs in this group are expected to have low to moderate acute oral toxicity. The toxicity appears to correlate with the degree of ethoxylation (highest for EO5–EO14) and is unlikely to be greatly affected by the alkyl chain length (HERA, 2009; REACHa-h). Unless data for the specific chemical are available to indicate otherwise, moderate acute oral toxicity cannot be ruled out and hazard classification is recommended for the remaining chemicals in this group (refer to the Recommendation section). The oral median lethal dose (LD50) values in rats ranged from 600 mg/kg bw (C15–16EO10, C14–15EO11) to 10000 mg/kg bw (CxEO1–3, CxEO>15). The discrepancy in study results was attributable to variations in EO chain lengths and study designs. No relationship between the alkyl chain length and acute oral toxicity was observed (HERA, 2009). At necropsy, congestion of the lung, liver and kidney, haemorrhage of the gastric mucosa, and gastrointestinal irritation (e.g. stomach ulcerations) were observed, particularly after administration of a bolus dose or undiluted chemicals (HERA, 2009).

	Based on the available data, the AEs in this group are expected to have low acute dermal toxicity. No structural relationship was evident between the AEs and acute dermal toxicity. In rabbits, the dermal LD50s were between 2000 to 5000 mg/kg bw. In rats, the dermal LD50 values ranged from >800 mg/kg bw (C13–15EO10, C13–15EO11) to >5000 mg/kg bw. At necropsy, haemorrhage of subcutaneous tissues and hyperaemia of the small intestine were observed (SCCP, 2007; HERA, 2009). At high doses (>16000 mg/kg bw after a 24-hour dermal application), AEs caused severe skin irritation, ataxia and lung lesions in rabbits (HERA, 2009; CIR, 2012). Based on the available data, the AEs in this group are expected to have low acute inhalation toxicity. In a study compliant with OECD Test Guideline (TG) 403 (Acute Inhalation Toxicity), a single static 6-hour exposure to substantially saturated vapour (131.58 ppm) of C6EO2 (CAS No. 112-59-4) resulted in no mortality or other signs of toxicity in rats (REACHa). In a non-guideline study, a median lethal concentration (LC50) of greater than 0.22 mg/L was reported for C9–11EO5 following 4-hour inhalation as a mist in rats. Other studies reported LC50 values from 1.5 to 20.7 mg/L, indicating that acute toxic thresholds were reached when rats were exposed to undiluted AEs in the form of respirable mists or aerosols, or at concentrations exceeding the saturated vapour pressure in air. At necropsy, corneal opacity, congestion and mottling of the lung, liver and kidney and adrenals were observed (HERA, 2009).
Irritation	Inhalation of droplets and/or particles (aerodynamic diameters <10 µm) released from the aerosolised products of these surfactant chemicals may cause respiratory irritation and consequent damage to the lung through prolonged or repeated exposure (NICNASa). Some of the AEs in this group are currently classified with hazard category ‘Skin Irritation – Category 2’ and hazard statement ‘H315 Causes skin irritation’ in the HCIS (refer to the Existing Work Health and Safety Controls section). Based on the available data, this hazard classification is recommended for the remaining chemicals in the group (unless data for the specific chemical are available to indicate otherwise) (refer to the Recommendation section). Overall, the degree of irritation was reported to be dependent on the type of patch (open vs vs semi-occluded vs occluded), exposure time (4 hours to 4 weeks), single vs repeated applications, and the concentration used. The chemicals were moderately to severely irritating at 100 %, slightly to moderately irritating at 10 %, mildly irritating at 1 %, and non-irritating at 0.1–0.5 %. The severity of irritation appears to inversely correlate with the degree of ethoxylation (i.e. more severe irritation for lower ethoxylation EO1–EO3) and is unlikely to be greatly affected by the alkyl chain length (HERA, 2009). In a number of OECD TG 404 (Acute Dermal Irritation/Corrosion) compliant tests, AEs of varying chain lengths were applied undiluted to intact rabbit skin for 4 hours under fully occluded conditions. The chemicals ranged from slightly irritating (C11EO9, C12–14EO15, C13EO20), moderately irritating (C12–14EO10, C13EO6, C13EO5–6.5) to extremely irritating (C12–14EO6, C12–14EO3, C13EO3). The skin reactions from slightly irritating chemicals reversed by 6 days after exposure, and those from moderately to severely irritating chemicals persisted up to 14 days of the observation period. The data suggest a possible trend between irritation and degree of ethoxylation, i.e. AEs with lower EO units are likely more irritating than those with higher number of EO units (HERA, 2009). Some of the AEs in this group are currently classified with hazard category ‘Eye Damage – Category 1’ and hazard statement ‘H318 Causes serious eye damage’ in the HCIS (refer to the Existing Work Health and Safety Controls section). Based on the available data, this hazard classification is recommended for the remaining chemicals in the group (unless data are available for the specific chemical to indicate otherwise) (refer to the Recommendation section).

	In summary, undiluted AEs caused moderate to severe eye irritation in rabbits. The chemicals were also reported to be slightly to moderately irritating at 1–10 % and non-irritating at 0.1 %. The severity of irritation was considered concentration-dependent and appears not to correlate with ethoxylation or alkyl chain length of the AEs. Rinsing the eye immediately after application of some AEs with tap water for 20–30 seconds reduced the severity of the effects. In a number of OECD TG 405 and Good Laboratory Practice (GLP) compliant tests, the majority of undiluted AEs covering the range of C9–C19 and EO2.5–EO15 resulted in Draize eye irritation index (EII) scores of >25 to 50, and were considered moderately to severely irritating. Some chemicals caused irreversible damage to the eye, i.e. conjunctivitis and corneal opacity which persisted to the end of the observation period of 21 days. Vascularisation of the cornea was observed following exposure to undiluted AEs (C7–9EO6 and C14–15EO11; both not listed on the Inventory). Other AEs (C12–13EO2, C7–9EO12, and C14–15EO7) have reported EII scores between 0.5 and 15 (mildly irritating). Thus, there is no clear pattern between the eye irritant responses versus the alkyl or EO chain lengths. Other tests demonstrated that the irritancy of the chemicals (covering the range of C9–C18 and EO3–EO20) could be reduced by rinsing the eye immediately after instillation. Concentrations of 0.1 % were non-irritating and between 1–10 % were slightly to moderately irritating (HERA, 2009). Similar results were reported from Draize tests in albino and New Zealand White rabbits, which covered the range of C9–C15 and EO1–EO18. These chemicals (CAS No. 68439-46-3, 66455-14-9, 68131-39-5 (group members) and 68951-67-7 (not on the Inventory) were severely to extremely irritating when tested undiluted and without rinsing, slightly to moderately irritating at 10 %, and non-irritating to mildly irritating at 0.1–1 % (CIR, 2012).
Sensitisation	Based on available data, the AEs in this group are not considered skin sensitisers. Overall, AEs showed no evidence of skin sensitisation, based on 25 guinea pig maximisation tests (covering the range of C9 to C21 and EO2 to EO21), 13 non-adjuvant Buehler tests (covering the range of C9 to C15 and EO3 to EO13), and local lymph node assay (LLNA) (available for C6EO2, CAS No. 112-59-4). Most of the studies were scientifically well-conducted, and some were compliant with the OECD TG and GLP (HERA, 2009; REACHa; REACHb; REACHc; REACHe; REACHf; REACHg; REACHh).
Health Effects Summary	Undiluted AEs (covering the range of C11–C18 and EO3–EO20) were reported to cause mild skin irritation in a number of standard human occlusive patch tests (4–24 hours). In some cases, mild erythema was observed and cleared within 72 hours (HERA, 2009; CIR, 2012).
Key Study/Critical Effect for Screening Criteria	The critical human health effects of the AEs for risk characterisation are acute oral toxicity and skin and eye irritation. The irritant effects are similar to those caused by other surfactants. The severity of irritation appears to increase directly with the chemical concentration. Skin irritation, but not eye irritation, generally decreases with an increasing degrees of ethoxylation. 90-day feeding studies in rats have been conducted on alcohol ethoxylates for group members (covering the range of C9–C18 and EO5–EO10). The lowest NOAEL from these studies is 50 mg/kg/day. The NOAEL of 50 mg/kg/day will be used to derive an oral reference dose and drinking water guidance value. Uncertainty factors: 10 (interspecies variability); 10 (intraspecies variability) Oral RfD = 50/100 = 0.5 mg/kg/dayDerived drinking water guideline value = 2 mg/L
Ecological Toxicity[2]	
Aquatic Toxicity	Acute toxicity: Fish: LL50 (96h) > 1.1 mg/L (geom. mean measured, OECD 203) Aquatic invertebrates: EL50 (48h): 0.544 mg/L (geom. mean measured, OECD 202) Algae: ErC50 (72h): 3.4 mg/L (meas. arith. mean, OECD 201) Chronic toxicity: Fish: no data available

	Aquatic invertebrates: NOEC (21 d): 0.218 mg/L (TWA, OECD 211) Algae: ErC10 (72h): 1.33 mg/L (meas. arith. mean, EU method C.3)
Determination of PNEC aquatic	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 chronic endpoint of 0.218 mg/L for Daphnia magna. The PNECaquatic is 0.00218 mg/L.
Current Regulatory Controls[1,3]	
Australian Hazard Classification	Acute Toxicity – Category 4; H302 (Harmful if swallowed) Skin Irritation – Category 2; H315 (Causes skin irritation) Eye Damage – Category 1; H318 (Causes serious eye damage)
Australian Occupational Exposure Standards	No specific exposure standards are available.
International Occupational Exposure Standards	No specific exposure standards are available.
Australian Food Standards	No data available.
Australian Drinking Water Guidelines	No data available.
Aquatic Toxicity Guidelines	Trigger values for freshwater (95% species) (ANZECC 2000): Alcohol ethoxyolated sulfate (AES) = 650 μgL^{-1} Alcohol ethoxylated surfactants (AE) = 140 μgL^{-1}
PBT Assessment[2]	
P/vP Criteria fulfilled?	No. These chemicals were found to be readily biodegradable. Thus, it does not meet the screening criteria for persistence.
B/vB criteria fulfilled?	No. Bioaccumulation in organisms is expected to be negligible, due to biotransformation and excretion of alcohol ethoxylates.
T criteria fulfilled?	No. The NOECs from the chronic aquatic toxicity data are >0.01 mg/L, hence does not meet the screening criteria for toxicity.
Overall conclusion	Not PBT

References

1. Australian Industrial Chemicals Introduction Scheme (AICIS) online database. IMAP, Human Health Tier II Assessment for Ethoxylates of aliphatic alcohols (>C6), Retrieved 2024: https://cdnservices.industrialchemicals.gov.au/statements/IMAP_424%20-%20IMAP%20Assessment%20-%2012%20December%202019.pdf.
2. ECHA REACH, Alcohols, C16-18, ethoxylated, Retrieved 2024: https://echa.europa.eu/registration-dossier/-/registered-dossier/13803.
3. HCIS, Hazardous Chemical Information System, Safe Work Australia, Retrieved 2024: http://hcis.safeworkaustralia.gov.au/HazardousChemical.

Toxicity Summary - [redacted]

Chemical and Physical Properties[1]	
CAS number	[redacted]
Molecular formula	UVCB
Molecular weight	UVCB
Solubility in water	100 g/L at 30 °C
Density	1.104 at 20 °C
Melting point	-57.27 °C
Boiling point	116.34 °C
Vapour pressure	2 hPa at 20 °C
Henrys law constant	No data available.
Explosive potential	Non-explosive
Flammability potential	No data available.
Colour/Form	Liquid
Overview	The substance is mixture of alkyl pyridine quaternary ammonium salts. Due to the nature of the material used to produce [redacted], the test substance is a complex multi component (UVCB) mixture.
Environmental Fate [1]	
Soil/Water/Air	The substance is a UVCB with mixed solubility characteristics. To determine the adsorption / desorption of [redacted], a screening test conducted in accordance with OECD 121 indicated that due to its multi component nature this chemical displayed a range of Log Koc values from <1.25 to 5.40. Similarly, [redacted] reported a Log Kow value of 3 at 25 °C. Whilst there is some potential for adsorption on the basis of these data, it is considered that the significant proportion of this chemical is mobile and water soluble.
Human Health Toxicity Summary[1]	
Chronic Repeated Dose Toxicity	No repeated dose toxicity data are available for the substance. Due to the corrosive nature of the substance and its likely low systemic absorption, it is considered that the effects of the substance are very likely to be limited to the site of contact. The substance is corrosive and (based on its physicochemical properties and read-across from similar quaternary ammonium compounds) is considered likely to be poorly systemically absorbed following oral administration. It is therefore very likely that the effects of the repeated oral administration in an animal study will be largely local (due to irritation/corrosion at the site of contact), with little or no systemic effects other than those secondary to the effects of the substance on the gastrointestinal tract.
Carcinogenicity	No data available.
Mutagenicity/ Genotoxicity	The results of an Ames test, a mouse lymphoma assay and a human lymphocyte micronucleus assay are all negative.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	No data are available, however reproductive and developmental toxicity are not predicted based on read across data.
Acute Toxicity	No acute toxicity data are available. The effects of acute exposure to the substance will be dominated by local irritation/corrosion at the site of contact and significant systemic toxicity is not predicted due to the likely poor absorption of the substance.
Irritation	No studies of skin or eye irritation were available as the substance is considered to be corrosive based on its low pH.

Toxicity Summary - Sodium Erythorbate

Chemical and Physical Properties[1,2]	
CAS number	6381-77-7
Molecular formula	C6H7NaO6
Molecular weight	199.13
Solubility in water	Soluble; 146 g/L at 20 °C and pH 6
Melting point	160 °C at 101.3 kPa
Boiling point	No data available.
Vapour pressure	No data available.
Henrys law constant	No data available.
Explosive potential	No data available.
Flammability potential	Non-flammable (100%)
Colour/Form	White, free-flowing crystals
Overview	Sodium erythorbate is a synthetic antioxidant used in food and cosmetic formulations. Foliar application of sodium erythorbate sprays and dusts are used to control young tree decline in citrus trees and to reduce ozone damage to Thompson seedless grapes. It is also used in hydraulic fracturing mixtures to prevent precipitation of metal oxides (iron control). This chemical has been identified by NICNAS to be of low concern to human health based on an initial screening approach and thus required no further assessment.
Environmental Fate[1]	
Soil/Water/Air	Limited environmental fate information is available for this chemical. Sodium erythorbate is expected to be readily biodegradable based on modelled predictions (USEPA BIOWIN).
Human Health Toxicity Summary[1]	
Chronic Repeated Dose Toxicity	Male 6-week-old F344 rats were given doses of 5% Sodium Erythorbate in feed for 168 days. Parameters of urinary excretion were investigated and the urinary bladder epithelium was examined using light and scanning electron microscopy at weeks 8, 16, and 24. The urine of rats fed Sodium Erythorbate had increased pH, elevated content of crystals and sodium, and decreased osmolality; however, no morphological alterations such as hyperplasia were detected in the mucosa. The urine values and urinary bladder mucosa were similar to controls at doses below 5 g/kg/day.
Carcinogenicity	F344/DuCrj rats of both sexes (6-week-old) were given 1.25% or 2.5% Sodium Erythorbate in drinking water for 104 weeks and untreated water for 8 additional weeks. Rats of the control group were given untreated water only. Each group consisted of 52 male and 50 female rats. Cumulative consumption of Sodium Erythorbate by male rats was 217 g/rat (1.25%) and 430 g/rat (2.5%). Consumption by females was 206 g/rat (1.25%) and 583 g/rat (2.5%). Body weight of rats given 2.5% Sodium Erythorbate was reduced by 8.5% for males and 15.5% for females at weeks 88 and 85, respectively, compared to controls. Body weight gain was normal in rats of the low dose group. All male treated and control rats (except two of the high-dose group) had testicular interstitial cell tumours. Various tumours occurred in 80% of control males, 69% of males given the low dose, and 78% of males given the high dose. A 6-18% incidence of leukaemia, pheochromocytoma, mammary fibroadenoma, and mesothelioma was observed. Of the females of the control, 1.25%, and 2.5% dose groups, 94%, 88%, and 78% had tumours, respectively. Twenty to 43% of females (all groups) had leukaemia, mammary fibroadenoma, endometrial stromal polyp and/or pituitary adenoma. Females given 2.5% Sodium Erythorbate had significantly fewer tumours than control females. The pattern of occurrence of the various types of tumours was similar among the groups. Sodium Erythorbate did not

	enhance the development of rare spontaneous tumours or transform benign tumours (e.g., solid adenoma of the thyroid) to carcinomas. The investigators concluded that Sodium Erythorbate was not carcinogenic in F344 rats.
Mutagenicity/ Genotoxicity	Sodium Erythorbate (99.8% pure; 5.0 mg/plate) was non-mutagenic in S. typhimurium strains TA92, TA94, TA98, TA100, TA1535, and TA1537 with and without S9 activation. Sodium Erythorbate (0.25 mg/mL plate) was also negative in the chromosomal aberration assay using Chinese hamster fibroblasts; Sodium Erythorbate did not induce the formation of polyploid cells after 48 hours, and caused 1 % chromosomal breaks after 24 hours.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	Sodium erythorbate did not cause maternal or fetal toxicity when administered to female rats and mice during gestation by oral intubation at dosages up to 1,030 mg/kg/day. Developmental toxicity did not occur after pregnant rats were given up to 5% sodium erythorbate in feed during a 13-week teratogenesis study. It produced negative results in the Ames test, the host-mediated assay using S. typhimurium, chromosomal aberration tests using Chinese hamster ovary fibroblasts, the dominant lethal test using rats, and the B. subtilis rec assay.
Acute Toxicity	Sodium erythorbate powder was applied to the intact and abraded skin of six rabbits as a single 2 g/kg dose. A substantial amount of residual compound was observed 24 hours after dosing. No erythema, edema, or other signs of dermal irritation were observed at five of six test sites. One rabbit (abraded skin) had slight (1+) erythema at 24 hours that cleared by 48 hours.
Irritation	Sodium erythorbate powder did not cause signs of dermal irritation when applied to the intact and abraded skin of rabbits. Instillation of sodium erythorbate powder to the conjunctival sac of rabbits caused slight and transient reddening of the conjunctiva that cleared within 24 hours.
Sensitisation	In a dermal sensitization study (according to OECD 429) with Sodium erythorbate (5, 10, 25% w/w in propylene glycol), young adult female CBA/Ca (CBA/CaOlaHsd) mice (4/group) were tested using the local lymph node assay (LLNA). In this study, Sodium erythorbate was not considered a potential skin sensitizer.
Health Effects Summary	Sodium erythorbate did not show signs of toxicity, carcinogenicity, mutagenicity, irritation and sensitisation in the studies reported. This chemical has been identified by NICNAS to be of low concern to human health.
Key Study/Critical Effect for Screening Criteria	The Australian drinking water guideline value for sodium may apply.
Ecological Toxicity [4]	
Aquatic Toxicity	The acute toxicity of sodium erythorbate to Algae was 1020 mg/L
Determination of PNEC aquatic	A PNECaquatic of 10.2 mg/L was calculated using an assessment factor of 100.
Current Regulatory Controls[4]	
Listed as a Chemical of Concern on International Databases	

International Database	Listed?
European REACH regulation Substances of very high concern (SVHCs) according to Annex XV https://echa.europa.eu/candidate-list-table	No
International Agency for Research on Cancer (IARC) as a Group 1, 2A or 2B carcinogen https://monographs.iarc.who.int/list-of-classifications	No
National Toxicology Program (NTP) Report on Carcinogens (RoC) https://ntp.niehs.nih.gov/whatwestudy/assessments/cancer/roc/index.html	No
US EPA Integrated Risk Information System (IRIS) as carcinogenic to humans, or likely / probable / possibly carcinogenic to humans EU list chemicals with endocrine disruption listed in Category 1 or Category 2 https://www.epa.gov/iris	No
United States Endocrine Disrupter Screening Program	No

	https://www.epa.gov/endocrine-disruption/endocrine-disruptor-screening-program-tier-1-screening-determinations-and	
	Agency for Toxic Substances and Disease Registry (ATSDR) as a neurotoxin https://wwwn.cdc.gov/TSP/index.aspx?sysid=18	No
	Montreal Protocol https://www.dcceew.gov.au/environment/protection/ozone/montreal-protocol	No
	Rotterdam Convention http://www.pic.int/TheConvention/Chemicals/AnnexIIIChemicals	No
	Stockholm Convention http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx	No
Australian Hazard Classification	No data available.	
Australian Occupational Exposure Standards	No data available.	
International Occupational Exposure Standards	No data available.	
Australian Food Standards	No data available.	
Australian Drinking Water Guidelines	No data available.	
Aquatic Toxicity Guidelines	No data available.	
PBT Assessment		
P/vP Criteria fulfilled?	No. The chemical readily biodegradable (based on modelled data).	
B/vB criteria fulfilled?	No. The Log Pow is -3.29 (Log Pow < 4.5) which does not meet the screening criteria for bioaccumulation.	
T criteria fulfilled?	No. Based on measured acute toxicity endpoints of greater than 1 mg/L Sodium erythorbate does not meet the screening criteria for toxicity.	
Overall conclusion	Not PBT	

References

1. HSDB (n.d.). *Hazardous Substances Data Bank*. Retrieved 2015, from Toxnet, Toxicology Data Network, National Library of Medicine: http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB
2. ECHA REACH, 2,3-didehydro-3-O-sodio-D-erythro-hexono-1,4-lactone, Retrieved 2019: https://echa.europa.eu/
3. Department of the Environment and Energy 2017, National assessment of chemicals associated with coal seam gas extraction in Australia, prepared by the National Industrial Chemicals Notification and Assessment Scheme
4. National Industrial Chemicals Notification and Assessment Scheme (NICNAS, 2017). National assessment of chemicals associated with coal seam gas extraction in Australia. Human health hazards of chemicals associated with coal seam gas extraction in Australia.

Toxicity Summary - [redacted]

Chemical and Physical Properties[1,2,3,4]	
CAS number	[redacted]
Molecular formula	Unspecified
Molecular weight	Unspecified
Solubility in water	[redacted]
Density	0.907 kg/L at 20°C [redacted]
Melting point	7.2 °C at 101.3 kPa (CAS 68131-39-5) -20 °C at 101.3 kPa (CAS 68439-46-3) -27 °C at 101 kPa (CAS 26183-52-8)
Boiling point	271.11 - 516.11 °C (CAS 68131-39-5) 260 °C (CAS 68439-46-3) 224 °C at 101 kPa (CAS 26183-52-8)
Vapour pressure	< 1 Pa at 25 °C (CAS 68131-39-5) 0.004 - 117 Pa at 20 °C (CAS 68439-46-3) 1 hPa at 20 °C (CAS 26183-52-8)
Henrys law constant	No data available.
Explosive potential	Non explosives
Flammability potential	Non flammable
Colour/Form	Organic liquid, colourless to light yellow
Overview	The AEs in this assessment are structurally related, where the hydrophilic ethylene oxide (EO) chain is attached via an ether linkage to the hydrophobic aliphatic alcohol chain (C =6). The alkyl chain can be linear, branched, saturated or unsaturated in the [redacted] group. Ethoxylated shorter chain alcohols (C <6) do not show the same degree of surface activity compared with longer chains, and hence they are not included in this assessment. A generic structural formula of the [redacted] is shown below: H–(CH2)x–y–(OCH2CH2)n–OH where n = average number of ethylene oxide (EO) units x–y = range of carbon units (C =6) A simpler notation of 'Cx–yEOn' will be used to represent the corresponding AEs in this assessment. Generally, increasing the carbon chain length increases lipophilicity, whereas increasing alkoxylation increases hydrophilicity of the chemical. These trends are consistent across the linear, branched, saturated or unsaturated AEs of varying alkyl chain lengths and ethoxylation degrees (Lindner, 2010). It was demonstrated that branching of the AEs had a relatively minor impact on calculated partition coefficients (Kow), and hence their biological properties (Lindner, 2010). Further, for unsaturated AEs, as the point of unsaturation is generally remote from the carbon where the EO chain is attached, they are expected to have similar physiochemical properties to saturated AEs. The AEs in this assessment have been shown to have similarities or trends in their toxicokinetic and toxicological profiles, although the alkyl chain length (whether linear, branched, saturated or unsaturated) and ethoxylation degree vary (see

	Health Hazard Information section). For this [redacted] group, SARs were reported between the degree of ethoxylation and the acute toxicity (direct) and skin irritation (inverse). On the basis of the analogue and chain-length category approach (i.e. by considering similarities and trends in molecular structure, physiochemical properties (Kow), uses, and hazard profiles), the AEs in this assessment are qualified to be assessed as a group. Based on such trend analyses, the available datasets for AEs ranging from C6–C18 and EO3–EO12 were considered representative of the [redacted] category for filling data gaps (HERA, 2009; Lindner, 2010). Available data for any AEs will be applicable to group members where data are incomplete or unavailable, such as for ethoxylates of coco, tallow, and C >20 alcohols. Overall, AEs are not expected to be systemically toxic, although some short chain ethylene glycol ethers, e.g. methyl and ethyl homologues are of concern for a range of adverse health effects. They include skin and eye irritation, liver and kidney damage, bone marrow and central nervous system (CNS) depression, testicular atrophy, developmental toxicity, and immunotoxicity. For higher propyl and butyl homologues, the toxicity involves haemolysis (anaemia) with secondary effects relating to haemosiderin accumulation in the spleen, liver and kidney, and compensatory haematopoiesis in the bone marrow. Systemic toxicity was shown to decrease with increasing alkyl chain lengths and/or alkoxylation degrees (ECETOC, 2005; US EPA, 2010). The chemicals ethylene glycol hexyl ether (with a longer alkyl chain length, CAS No. 112-25-4) and diethylene glycol butyl ether (with a higher ethoxylation degree, CAS No. 112-34-5) have no evidence of systemic effects including haemolysis (ECETOC, 2005; NICNASc). Commercially available AEs are mixtures of homologues of varying carbon chain lengths and it is possible that some of the chemicals with an average alkyl chain length C =6 may also contain shorter alkyl chains C <6. It is not practical to quantify the proportion of shorter C <6 chain lengths present in such chemicals, or these shorter chain lengths may not be present at all. The available data suggest a lack of systemic toxicity for the [redacted] chemicals with potential short alkyl chain presence; therefore, the toxicity of the chemicals in this assessment is unlikely to be significantly affected by the presence of shorter chain alkyl groups.
Environmental Fate[2,3]	
Soil/Water/Air	[redacted] are readily biodegradable under aerobic conditions and also anaerobically biodegradable (HERA, 2009). The main mechanism of primary biodegradation for the linear and essentially linear [redacted] is the central cleavage of the molecule, leading to the formation of long chain alcohol and polyethylene glycol (HERA, 2009; Marcomini et al., 2000a; Marcomini et al., 2000b). Long chain alcohols themselves are readily biodegradable up to C18 (SIDS, 2006). Abiotic degradation in water, soil, sediment and air is not expected to occur because of the chemical structures of [redacted] homologues. Neither hydrolysis under normal environmental conditions (pH range from 4 to 9) nor photolysis in the atmosphere, in water, or when absorbed to soil and sediment surfaces, is to be considered (HERA, 2009). Experimentally determined BCF-values given for pure homologues and summarized in the publication of Tolls et al. (2000) are used as read-across data for the endpoint bioaccumulation in water. It can be stated that bioaccumulation of [redacted] is regarded to be negligible as the surfactants will be rapidly metabolised. For more detail see endpoint summary for bioaccumulation. Concerning transport and distribution of the alcohol ethoxylate mixtures a high adsorption of the substances is determined by using QSAR-models. Adsorption onto surfaces is an intrinsic property of [redacted] and thus a high Koc-value is expected.

Human Health Toxicity Summary[1]	
Chronic Repeated Dose Toxicity	Based on the available data, the chemicals in this group are not expected to cause serious damage to health (apart from local effects) from repeated oral and dermal exposure. In several 90-day feeding studies in rats (similar to OECD TG 408), the reported NOAELs were between 50 and 700 mg/kg bw/day for group members (covering the range of C9–C18 and EO5–EO10). Effects observed at higher concentrations included reduced mean body weights and increases in relative liver, kidney and heart weights (SCCS, 2007; HERA 2009; CIR, 2012). Similar effects were seen in longer-term 2-year feeding studies in rats. The NOAEL for the AEs CAS No. 66455-14-9 (C12–13EO6.5 group member) and CAS No. 68951-67-7 (C14–15EO7 not listed on the Inventory) were between 50 and 190 (females) mg/kg bw/day (HERA, 2009; CIR, 2012). Repeated oral or inhalation exposure to certain short chain ethylene glycol ethers (EGEs), such as 2-butoxyethanol (ethylene glycol butyl ether, EGBE, CAS No. 111-76- 2) and its acetate (EGBEA, CAS No. 112-07-2), may cause haemolytic effects in rodents and effects on the liver, spleen and kidney. However, humans appear to be the least sensitive species for haemolytic effects (NICNAS, 1996; NICNASc; OECD, 2004; ECETOC, 2005). The AEs in this assessment are not expected to share these mechanisms of toxicity. Therefore, exposure to these AEs is not expected to cause haemolysis and associated organ toxicity in humans. In a well-reported OECD TG 411 (Subchronic 90-day Dermal Toxicity) study, Fischer rats were exposed to C9–11EO6 (CAS No. 68439-46-3) at 1, 10 or 25 % concentrations, 3 days/week. The application site was shaved and not covered. Dry, flaky skin and irritation (epidermal thickening with hyperkeratosis) were observed at >10 %. Relative kidney weights without histological lesions increased in both sexes at 25 %. The NOAEL was established at 10 %, equivalent to 80 mg/kg bw/day (HERA, 2009; CIR, 2012). In an 18-month study, C12–13EO6.5 was applied to the back of Swiss mice 3 days/week. There were no treatment-related systemic lesions at up to 270 mg/kg bw/day. No further study information was available (HERA, 2009).
Carcinogenicity	Based on the available data, chemicals in this group are not considered carcinogenic. Two AEs, CAS No. 66455-14-9 (C12–13EO6.5, group chemical) and CAS No. 68951-67-7 (C14–15EO7, not listed on the Inventory), were administered at up to 1 % in the diet to rats for 1–2 years. No treatment-related histopathological effect or increased tumour incidence were observed (HERA, 2009; CIR, 2012). There was no treatment-related lesions in mice, following 18-month dermal application of C12–13EO6.5 (HERA, 2009). The AEs are synthesised through processes which may result in 1,4-dioxane as an impurity. This impurity is classified as a Carcinogen—Category 2 (H351 Suspected of causing cancer). There are restrictions on the levels of this chemical in preparations available to consumers in Australia (SUSMP).
Mutagenicity/ Genotoxicity	Based on the data available, the chemicals in this group are not considered mutagenic or genotoxic. A broad spectrum of AEs (covering the range of C7–C22 and EO2–EO20) tested negative in multiple in vitro and in vivo tests (OECD and GLP compliant) for gene mutation and clastogenicity. In vitro, negative results were reported in bacterial reverse mutation tests in Salmonella typhimurium (TA98, TA100, TA102, TA104, TA1535, TA1537 and TA1538) and Escherichia coli (strains WP2 and WP2 uvrA pKM101), with or without metabolic activation. Negative results were also reported in chromosomal aberration tests (Chinese hamster lung V79, Chinese hamster ovary, and rat liver

	cells) and gene mutation tests (mouse lymphoma cells) (SCCP, 2007; HERA, 2009; CIR, 2012). In vivo, AEs (C12–C15 and EO3–EO9) did not induce chromosomal damage in Chinese hamster or Tunstall Wistar rat bone marrow cells after acute oral doses between 250 and 3400 mg/kg bw (SCCP, 2007; HERA, 2009).
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	Based on the data available, the chemicals of this group are not considered to cause reproductive or developmental toxicity. The oral NOAELs were determined at 250 mg/kg bw/day for reproductive toxicity, and >50 mg/kg bw/day for maternal and developmental toxicity. In a 2-generation study, the chemical C14–15EO7 was administered in the diet of Charles River CD rats (25/sex/group, at doses of 0, 25, 50 or 250 mg/kg bw/day). The NOAEL for reproductive toxicity was established as 250 mg/kg bw/day (or 0.5 % in diet), given no treatment related effects on fertility, gestation or viability index at this highest tested dose. The NOAEL for maternal and developmental toxicity was established as 50 mg/kg bw/day, based on reduced maternal and pup body weights and increased relative liver weights in both F1 (males and females) and F2 (males) generations at 250 mg/kg bw/day (HERA 2009; CIR, 2012). In a 2-generation study protocol using a different [redacted] (C12EO6), the NOAEL for reproductive toxicity was set at the highest tested dose of 250 mg/kg bw/day. The NOAELs for parental (F0) and developmental toxicity were also 50 mg/kg bw/day, based on reduced body weight gains in F0 and F1 generations at 250 mg/kg bw/day (HERA, 2009; CIR 2012). In an oral developmental toxicity study, C12EO6 was administered in the diet of female rabbits at doses of 0, 50, 100 or 200 mg/kg bw/day from gestation days 2 to 16. Ataxia and a slight decrease in body weight were observed at =100 mg/kg bw/day. Nine rabbits in the control group and 31 in the treatment groups died during the study (details not available). There were no treatment related effects on corpora lutea, implantations, number of live foetuses and spontaneous abortions. No further information was available on live birth index, pup growth or developmental NOAEL. The NOAEL for maternal toxicity was reported at the lowest dose tested, i.e. 50 mg/kg bw/day (HERA, 2009; CIR, 2012). In a dermal 2-generation study, C9–11EO6 (CAS No. 68439-46-3) was applied to Fischer 344 rats (30/sex/group, at doses of 0, 10, 100 or 250 mg/kg bw/day, 3 times/week except mating periods). No effects were reported on mating, fertility or mean gestational length in both generations. No treatment-related effects on testicular weights or sperm counts were observed. There were no effects on F1 and F2 litter size, number of live pups or sex ratio. The NOAEL for reproductive and developmental toxicity was established as 250 mg/kg bw/day (HERA 2009; CIR, 2012). In 2 other dermal studies, the NOAEL values for developmental and teratogenicity of C12EO4 were reported at >240–300 mg/kg bw/day for rats and rabbits, respectively (HERA, 2009). Although certain short chain EGEs such as 2-ethoxyethanol (ethylene glycol ethyl ether, EGEE, CAS No. 110-80-5) are known reproductive toxicants, the ability of these glycol ethers to cause testicular atrophy decreases with increasing alkyl chain length, with effects not observed with chain lengths =C3 (OECD, 2004; ECETOC, 2005). In addition, no effects on reproductive organs were observed in several repeated dose toxicity studies (refer to the Repeated dose toxicity section above).
Acute Toxicity	Some of the AEs in this group are currently classified with hazard category 'Acute Toxicity – Category 4' and hazard statement 'H302 Harmful if swallowed' in the HCIS (refer to the Existing Work Health and Safety Controls section). Based on the available animal data and international reviews, the AEs in this group are expected to have low to moderate acute oral toxicity. The toxicity appears to correlate with the degree of ethoxylation (highest for EO5–EO14) and is unlikely to be greatly affected by the alkyl chain length (HERA, 2009; REACHa-h). Unless data for the specific chemical are available to indicate otherwise, moderate acute oral toxicity

	cannot be ruled out and hazard classification is recommended for the remaining chemicals in this group (refer to the Recommendation section). The oral median lethal dose (LD50) values in rats ranged from 600 mg/kg bw (C15–16EO10, C14–15EO11) to 10000 mg/kg bw (CxEO1–3, CxEO>15). The discrepancy in study results was attributable to variations in EO chain lengths and study designs. No relationship between the alkyl chain length and acute oral toxicity was observed (HERA, 2009). At necropsy, congestion of the lung, liver and kidney, haemorrhage of the gastric mucosa, and gastrointestinal irritation (e.g. stomach ulcerations) were observed, particularly after administration of a bolus dose or undiluted chemicals (HERA, 2009). Based on the available data, the AEs in this group are expected to have low acute dermal toxicity. No structural relationship was evident between the AEs and acute dermal toxicity. In rabbits, the dermal LD50s were between 2000 to 5000 mg/kg bw. In rats, the dermal LD50 values ranged from >800 mg/kg bw (C13–15EO10, C13–15EO11) to >5000 mg/kg bw. At necropsy, haemorrhage of subcutaneous tissues and hyperaemia of the small intestine were observed (SCCP, 2007; HERA, 2009). At high doses (>16000 mg/kg bw after a 24-hour dermal application), AEs caused severe skin irritation, ataxia and lung lesions in rabbits (HERA, 2009; CIR, 2012). Based on the available data, the AEs in this group are expected to have low acute inhalation toxicity. In a study compliant with OECD Test Guideline (TG) 403 (Acute Inhalation Toxicity), a single static 6-hour exposure to substantially saturated vapour (131.58 ppm) of C6EO2 (CAS No. 112-59-4) resulted in no mortality or other signs of toxicity in rats (REACHa). In a non-guideline study, a median lethal concentration (LC50) of greater than 0.22 mg/L was reported for C9–11EO5 following 4-hour inhalation as a mist in rats. Other studies reported LC50 values from 1.5 to 20.7 mg/L, indicating that acute toxic thresholds were reached when rats were exposed to undiluted AEs in the form of respirable mists or aerosols, or at concentrations exceeding the saturated vapour pressure in air. At necropsy, corneal opacity, congestion and mottling of the lung, liver and kidney and adrenals were observed (HERA, 2009).
Irritation	Inhalation of droplets and/or particles (aerodynamic diameters <10 µm) released from the aerosolised products of these surfactant chemicals may cause respiratory irritation and consequent damage to the lung through prolonged or repeated exposure (NICNASa). Some of the AEs in this group are currently classified with hazard category ‘Skin Irritation – Category 2’ and hazard statement ‘H315 Causes skin irritation’ in the HCIS (refer to the Existing Work Health and Safety Controls section). Based on the available data, this hazard classification is recommended for the remaining chemicals in the group (unless data for the specific chemical are available to indicate otherwise) (refer to the Recommendation section). Overall, the degree of irritation was reported to be dependent on the type of patch (open vs vs semi-occluded vs occluded), exposure time (4 hours to 4 weeks), single vs repeated applications, and the concentration used. The chemicals were moderately to severely irritating at 100 %, slightly to moderately irritating at 10 %, mildly irritating at 1 %, and non-irritating at 0.1–0.5 %. The severity of irritation appears to inversely correlate with the degree of ethoxylation (i.e. more severe irritation for lower ethoxylation EO1–EO3) and is unlikely to be greatly affected by the alkyl chain length (HERA, 2009). In a number of OECD TG 404 (Acute Dermal Irritation/Corrosion) compliant tests, AEs of varying chain lengths were applied undiluted to intact rabbit skin for 4 hours under fully occluded conditions. The chemicals ranged from slightly irritating

	(C11EO9, C12–14EO15, C13EO20), moderately irritating (C12–14EO10, C13EO6, C13EO5–6.5) to extremely irritating (C12–14EO6, C12–14EO3, C13EO3). The skin reactions from slightly irritating chemicals reversed by 6 days after exposure, and those from moderately to severely irritating chemicals persisted up to 14 days of the observation period. The data suggest a possible trend between irritation and degree of ethoxylation, i.e. AEs with lower EO units are likely more irritating than those with higher number of EO units (HERA, 2009). Some of the AEs in this group are currently classified with hazard category 'Eye Damage – Category 1' and hazard statement 'H318 Causes serious eye damage' in the HCIS (refer to the Existing Work Health and Safety Controls section). Based on the available data, this hazard classification is recommended for the remaining chemicals in the group (unless data are available for the specific chemical to indicate otherwise) (refer to the Recommendation section). In summary, undiluted AEs caused moderate to severe eye irritation in rabbits. The chemicals were also reported to be slightly to moderately irritating at 1–10 % and non-irritating at 0.1 %. The severity of irritation was considered concentration-dependent and appears not to correlate with ethoxylation or alkyl chain length of the AEs. Rinsing the eye immediately after application of some AEs with tap water for 20–30 seconds reduced the severity of the effects. In a number of OECD TG 405 and Good Laboratory Practice (GLP) compliant tests, the majority of undiluted AEs covering the range of C9–C19 and EO2.5–EO15 resulted in Draize eye irritation index (EII) scores of >25 to 50, and were considered moderately to severely irritating. Some chemicals caused irreversible damage to the eye, i.e. conjunctivitis and corneal opacity which persisted to the end of the observation period of 21 days. Vascularisation of the cornea was observed following exposure to undiluted AEs (C7–9EO6 and C14–15EO11; both not listed on the Inventory). Other AEs (C12–13EO2, C7–9EO12, and C14–15EO7) have reported EII scores between 0.5 and 15 (mildly irritating). Thus, there is no clear pattern between the eye irritant responses versus the alkyl or EO chain lengths. Other tests demonstrated that the irritancy of the chemicals (covering the range of C9–C18 and EO3–EO20) could be reduced by rinsing the eye immediately after instillation. Concentrations of 0.1 % were non-irritating and between 1–10 % were slightly to moderately irritating (HERA, 2009). Similar results were reported from Draize tests in albino and New Zealand White rabbits, which covered the range of C9–C15 and EO1–EO18. These chemicals (CAS No. 68439-46-3, 66455-14-9, 68131-39-5 (group members) and 68951-67-7 (not on the Inventory) were severely to extremely irritating when tested undiluted and without rinsing, slightly to moderately irritating at 10 %, and non-irritating to mildly irritating at 0.1–1 % (CIR, 2012).
Sensitisation	Based on available data, the AEs in this group are not considered skin sensitisers. Overall, AEs showed no evidence of skin sensitisation, based on 25 guinea pig maximisation tests (covering the range of C9 to C21 and EO2 to EO21), 13 non-adjuvant Buehler tests (covering the range of C9 to C15 and EO3 to EO13), and local lymph node assay (LLNA) (available for C6EO2, CAS No. 112-59-4). Most of the studies were scientifically well-conducted, and some were compliant with the OECD TG and GLP (HERA, 2009; REACHa; REACHb; REACHc; REACHe; REACHf; REACHg; REACHh).
Health Effects Summary	Undiluted AEs (covering the range of C11–C18 and EO3–EO20) were reported to cause mild skin irritation in a number of standard human occlusive patch tests (4–24 hours). In some cases, mild erythema was observed and cleared within 72 hours (HERA, 2009; CIR, 2012).
Key Study/Critical Effect for Screening Criteria	The critical human health effects of the AEs for risk characterisation are acute oral toxicity and skin and eye irritation. The irritant effects are similar to those caused by other surfactants. The severity of irritation appears to increase directly with the chemical concentration. Skin irritation, but not eye irritation, generally decreases with an increasing degrees of ethoxylation. Two-year dietary studies in rats have been conducted on [redacted] $C_{12-13}AE_{6.5}$ and $C_{14-15}AE_{7}$ (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. Uncertainty factors: 10 (interspecies variability); 10 (intraspecies variability) Oral RfD = 50/100 = 0.5 mg/kg/dayDerived drinking water guideline value = 2 mg/L
Ecological Toxicity[2,3]	
Aquatic Toxicity	The 96 h LC50 value for Alcohols, C9 – 11, ethoxylated with Oncorhynchus mykiss was 5 – 7 mg/L based on nominal concentrations. In the long-term toxicity test to Lepomis macrochirus, the NOEC (30 days) was 0.11 – 0.33 mg/L. In the short-term toxicity test to Daphnia magna, the EC50 (48 h) was 2.5 mg/L. In the long-term toxicity test to Daphnia magna, the NOEC (21 days) was 0.77 – 1.75 mg/L. In the short–term toxicity test to Pseudokirchneriella subcapitata (green algae), the EC50 (96 h) was 1.4 mg/L. The EC50 (3 h) for microorganisms was 140 mg/L. In a study conducted with two different fish species (bluegill sunfish and fathead minnow) the effects of C14 -15 [redacted] (7EO) were determined (Dorn et al., 1995, Shell). In two experiments fish were exposed for 10 d in a laboratory assay and for 30 d in an outdoor stream mesocosm. Effect parameters determined were survival and growth of juvenile bluegills and survival and reproduction of fathead minnows. In the laboratory experiment the NOEC for survival and swimming performance of bluegills and for survival of fathead minnows was 0.16 mg/L. In the stream mesocosm the NOEC for bluegill survival and growth was >0.33 mg/L and for fathead minnow survival 0.28 mg/L. There was an indication of decreased egg laying by fathead minnow in the streams at concentrations of 0.33 mg/L or greater. On the basis of the reported results a worst-case NOEC of 0.16 mg/L is assumed. One publication is available for an alcohol ethoxylate mixture with a chain length of C12 - C13 and approximately 6.5 ethoxy groups (Gillespie et al. 1999). The 21 days flow-through chronic experiment on daphnids is conducted according to the guidelines USEPA-TSCA (U.S. EPA, 1992) and ASTM (1988) and is well documented in the paper. Nevertheless, the degree of ethoxylation of the tested mixture described in the paper (6.5 EO) is higher than the degree of ethoxylation described for CAS 68131-39-5 (2.5 EO). The NOEC of 0.77 mg/L for reproduction can be used for read-across.
Determination of PNEC aquatic	A PNECaquatic of 11 µg/L was calculated using the lowest chronic endpoint of NOEC of 0.11 mg/L for Daphnia magna. An assessment factor of 10 was used.
Current Regulatory Controls[1]	
Listed as a Chemical of Concern on International Databases	

International Database	Listed?
European REACH regulation Substances of very high concern (SVHCs) according to Annex XV https://echa.europa.eu/candidate-list-table	No
International Agency for Research on Cancer (IARC) as a Group 1, 2A or 2B carcinogen	No
National Toxicology Program (NTP) Report on Carcinogens (RoC) https://ntp.niehs.nih.gov/whatwestudy/assessments/cancer/roc/index.html	No
US EPA Integrated Risk Information System (IRIS) as carcinogenic to humans, or likely / probable / possibly carcinogenic to humans EU list chemicals with endocrine disruption listed in Category 1 or Category 2 https://www.epa.gov/iris	No
United States Endocrine Disrupter Screening Program https://www.epa.gov/endocrine-disruption/endocrine-disruptor-screening-program-tier-1-screening-determinations-and	No
Agency for Toxic Substances and Disease Registry (ATSDR) as a neurotoxin https://wwwn.cdc.gov/TSP/index.aspx?sysid=18	No
Montreal Protocol https://www.dcceew.gov.au/environment/protection/ozone/montreal-protocol	No

	Rotterdam Convention http://www.pic.int/TheConvention/Chemicals/AnnexIIIChemicals — No Stockholm Convention http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx — No
Australian Hazard Classification	Alcohols, C12-16, ethoxylated are classified as hazardous on the Hazardous Chemicals Information System (HCIS), with the hazard categories and hazard statements for human health (Safe Work Australia): Acute Toxicity – Category 4; H302 (Harmful if swallowed) Skin Irritation – Category 2; H315 (Causes skin irritation) Eye Damage – Category 1; H318 (Causes serious eye damage)
Australian Occupational Exposure Standards	No specific exposure standards are available.
International Occupational Exposure Standards	No specific exposure standards are available.
Australian Food Standards	No data available.
Australian Drinking Water Guidelines	No data available.
Aquatic Toxicity Guidelines	Trigger values for freshwater (95% species) (ANZECC 2000): Alcohol ethoxyolated sulfate (AES) = 650 μgL^{-1} [redacted] surfactants ([redacted]) = 140 μgL^{-1}
PBT Assessment	
P/vP Criteria fulfilled?	No. These chemicals were found to be readily biodegradable. Thus, it does not meet the screening criteria for persistence.
B/vB criteria fulfilled?	No. Bioaccumulation in organisms is expected to be negligible, due to biotransformation and excretion of [redacted].
T criteria fulfilled?	No. The NOECs from the chronic aquatic toxicity data are >0.01 mg/L, hence does not meet the screening criteria for toxicity.
Overall conclusion	Not PBT

References

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Toxicity Summary - [redacted]

Chemical and Physical Properties[1]	
CAS number	[redacted]
Molecular formula	[redacted]
Molecular weight	[redacted]
Solubility in water	68 mg/L at 20 °C
Density	0.959 at 20 °C
Melting point	-21.15°C
Boiling point	250°C
Vapour pressure	1 Pa at 25 °C
Henrys law constant	1.26 x 10^{-7} atm-m3/mole [redacted] 2.24 x 10^{-7} atm-m3/mole [redacted] 9.77 x 10^{-8} atm-m3/mole [redacted]
Explosive potential	Non-explosive (100%)
Flammability potential	No data available.
Colour/Form	Liquid, slight odour
Overview	[redacted]s expected to be of low concern based on experimental and modelled data (EPA Safer Choice). [redacted] has been listed as chemicals unlikely to require further regulation to manage risks to health by AICIS.
Environmental Fate	
Soil/Water/Air	No data available.
Human Health Toxicity Summary[4]	
Chronic Repeated Dose Toxicity	No data available for the [redacted] esters, however read-across data available for the dimethyl esters: Oral route (14 days, rat): NOEL = 10,000 ppm (equivalent to 980 mg/kg bw) Dermal route (14 days, rat): NOEL (systemic toxicity) = 1000 mg/kg bw Inhalation (90 days, rat): NOEC (respiratory local toxicity) = 50 mg/m^3
Carcinogenicity	No data available
Mutagenicity/ Genotoxicity	Overall, based on the available read across information, the genetic toxicity of dibasic ester blend is considered to be negative.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	There are no data available on the reproductive toxicity of the [redacted] esters of adipic, succinic and glutaric acid. However, data exist for the methyl esters of these acids, isobutanol and dibutyl adipate (a structurally similar analogue to one of the components). Dosing of the [redacted] esters will result in the release of the acids and isobutanol, therefore read across to the dimethyl esters is considered appropriate since the major hydrolysis product of the dimethyl esters is the acids. In support of this, data on isobutanol are also provided to address the isobutanol that would be released from the [redacted] esters once entering the body. In developmental toxicity studies, no effects were observed on mating performance, fertility, gestation duration, litter size, development or viability, and lactation performance in rats by inhalation.

Acute Toxicity	Oral: In the key study, this substance produced no deaths in an acute oral fixed dose toxicity study at the limit dose of 2000 mg/kg bw. In a second study, the LD50 was determined to be 16,426 mg/kg bw/day (95% CI >15295, <18189, Slope 15.9). Based on these data this substance is not considered to be acutely toxic via the oral route. Dermal and Inhalation: No data are available for the dermal and inhalation acute toxicity of this substance. However, the oral route is likely to lead to the highest degree of systemic exposure and the acute oral toxicity data demonstrate this substance is not acutely toxic. It is therefore very unlikely that exposure via dermal or inhalation routes would lead to systemic toxicity capable of producing death at doses relevant for classification. This conclusion is supported by the read across to the methyl esters of the same acids, where acute dermal and inhalation toxicity was minimal (LD50 >2000 mg/kg via dermal and LC50> 11 mg/L via inhalation).
Irritation	Skin: In a well conducted skin irritation study this substance failed to produce signs of irritation. Eye: In a well conducted eye irritation study this substance produced some minimal signs of irritation but they did not persist nor were they sufficient for classification. Respiratory: No data were available for this substance. Data on the available read across substances (dimethyl esters) indicate that there are some signs of histopathological signs of local irritation in the upper respiratory tract in animals dosed via the inhalation route. There were no changes in breathing pattern associated with these changes. This substance also has a higher vapour pressure than the [redacted] esters and so potential for inhalation exposure leading to irritation is minimal. There was no evidence in humans of respiratory irritation when handling this material. Therefore, this substance is not considered to be a respiratory irritant.
Sensitisation	Not sensitising
Health Effects Summary	Not expected to be acutely toxic, irritating or sensitising. No signs of immediate or massive upper respiratory tract irritation are observed following inhalation of dibasic ester blend in rats or humans.
Key Study/Critical Effect for Screening Criteria	Expected to be of low concern to human health: [redacted] is expected to be of low concern based on experimental and modelled data (EPA Safer Choice). [redacted] has been listed as chemicals unlikely to require further regulation to manage risks to health by AICIS.
Ecological Toxicity[4]	
Aquatic Toxicity	For fish, one reliable acute study with the juvenile turbot (Scopthalmus maximus) was available for assessment. The LL50 was >1.6 mg/L and based on the acute 96-hour exposure. For invertebrates, one reliable acute study with the marine copepod (Acartia tonsa) was available for assessment. The LL50 was 25 mg/L, based on the acute 48-hour exposure. For the algal species, one reliable study with Skeletonema costatumas the test species was available for assessment. The EL50 and NOELR for the marine water species were 7.9 mg/L and 1.0 mg/L, respectively and based on growth rate following 72-hours of exposure.
Determination of PNEC aquatic	On the basis that the data consists of only short-term results from three trophic levels, an assessment factor of 1000 has been applied to the lowest reported acute endpoint of 1.6 mg/L for fish. The PNECaquatic is 0.0016 mg/L.
Current Regulatory Controls [1,2,4]	
Listed as a Chemical of Concern on International Databases	

International Database	Listed?
European REACH regulation Substances of very high concern (SVHCs) according to Annex XV https://echa.europa.eu/candidate-list-table	No
International Agency for Research on Cancer (IARC) as a Group 1, 2A or 2B carcinogen	No

	https://monographs.iarc.who.int/list-of-classifications	
	National Toxicology Program (NTP) Report on Carcinogens (RoC) https://ntp.niehs.nih.gov/whatwestudy/assessments/cancer/roc/index.html	No
	US EPA Integrated Risk Information System (IRIS) as carcinogenic to humans, or likely / probable / possibly carcinogenic to humans EU list chemicals with endocrine disruption listed in Category 1 or Category 2 https://www.epa.gov/iris	No
	United States Endocrine Disrupter Screening Program https://www.epa.gov/endocrine-disruption/endocrine-disruptor-screening-program-tier-1-screening-determinations-and	No
	Agency for Toxic Substances and Disease Registry (ATSDR) as a neurotoxin https://wwwn.cdc.gov/TSP/index.aspx?sysid=18	No
	Montreal Protocol https://www.dcceew.gov.au/environment/protection/ozone/montreal-protocol	No
	Rotterdam Convention http://www.pic.int/TheConvention/Chemicals/AnnexIIIChemicals	No
	Stockholm Convention http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx	No
Australian Hazard Classification	No data available.	
Australian Occupational Exposure Standards	No data available.	
International Occupational Exposure Standards	No data available.	
Australian Food Standards	No data available.	
Australian Drinking Water Guidelines	No data available.	
Aquatic Toxicity Guidelines	No data available.	
PBT Assessment[4]		
P/vP Criteria fulfilled?	No. The chemical is predicted to be readily biodegradable.	
B/vB criteria fulfilled?	No. The predicted BCF values were between 12.6 to 15 L/kg (<2000 L/kg). Thus, the chemical does not meet the screening criteria for bioaccumulation.	
T criteria fulfilled?	No. The acute toxicity to invertebrates, fish, and algae are > 1 mg/L.	
Overall conclusion	Not PBT	

References

1. PubChem Compound Summary. National Center for Biotechnology Information. (PubChem). Retrieved 2024: https://pubchem.ncbi.nlm.nih.gov/.
2. United States Environmental Protection Agency (US EPA) 2024. CompTox Chemicals Dashboard. Version 2.4.1, April 2024. Retrieved 2024: [redacted]
3. Australian Industrial Chemicals Introduction Scheme (AICIS) online database. Chemicals that are unlikely to require further regulation to manage risks to health, Retrieved 2024: [redacted]
4. ECHA REACH, [redacted]

Toxicity Summary - Hydrochloric acid

Chemical and Physical Properties [1,2,3,4]	
CAS number	7647-01-0
Molecular formula	HCl
Molecular weight	36.46 g/mol
Solubility in water	Soluble
Melting point	-114.22 °C
Boiling point	-85.05°C
Vapour pressure	35,424 mm Hg at 25 deg C
Henrys law constant	2.04 x106 mol/L atm
Explosive potential	Reacts with most metals producing explosive hydrogen gas
Flammability potential	Not combustible
Colour/Form	Liquid
Overview	Hydrochloric acid has demonstrated acute oral toxicity, corrosive effects to the skin and eye, and irritant effects to the respiratory system. Following absorption, the chemical dissociates rapidly into hydrogen ions (protons) and chloride ions, which are both normal, homeostatically regulated components of the human body. Hydrochloric acid is a direct acting corrosive and irritant and adverse effects are caused at the site of contact by deposition of protons (causing pH change) rather than effects of the chloride ion. Exposure by inhalation, dermal or oral route at high concentrations has therefore been considered as inappropriate. If released to water, hydrogen chloride dissociates readily in water to chloride and hydronium ions, decreasing the pH of the water. Hydrochloric acid is one of the most widely used industrial chemicals. Uses include pickling and cleaning metals, food process, and cleaning of industrial equipment.
Environmental Fate [5,6]	
Soil/Water/Air	Hydrochloric acid is readily dissociated in water into hydrated protons and chloride ions. The increase in the concentration of hydrochloric acid in water decreases the pH in the aquatic ecosystem. Generally, the buffer capacity to maintain the pH in the aquatic ecosystem is important and the equilibrium between CO2, HCO3 - and CO3 2- in the aquatic ecosystem is mainly responsible for the buffer capacity of receiving water.

Human Health Toxicity Summary [1,2,3,4,9]	
Chronic Repeated Dose Toxicity	In a repeated dose study (non-guideline), rats were fed diets containing the chemical at 312, 625, 937 or 1250 millimoles/kg diet (180, 349, 366 or 466 mg/animal/day) for nine weeks. Water intake was high in all treatment groups. A no observed adverse effect level (NOAEL) of 625 mmol/kg diet (349 mg/kg bw) was determined based on mortalities (100 %) at 937 mmol/kg diet and above. The other effects reported include decreased body weight and food consumption, changes to blood pH and femur length at 937 mmol/kg diet and above (OECD, 2005). Based on the available data, the chemical is not considered to cause serious damage to health from repeated inhalation exposure. However, local irritation effects are expected due to the corrosivity of the chemical. Studies reporting exposure to hydrogen chloride gas are available. Rats and mice were exposed to the chemical gas (equivalent to OECD TG 413) at concentrations of 0, 10, 20 or 50 ppm (0, 15, 30 or 75 mg/m^3), six hours/day, five days/week for 90 days. Mice showed decreased body weight gain, food consumption and liver weight (in males only) at 50 ppm. Decreased body weight gain was observed in male rats at 50 ppm and food consumption was reduced in both sexes at 20 and 50 ppm. Inflammatory histopathological changes in lips or the nasal cavity were observed in mice and rats above 10 ppm. The no observed adverse effect concentration (NOAEC) for systemic toxicity was determined to be 20 ppm for rats and mice based on the reduction in body weight gain and liver weight (in male mice) (OECD, 2005).
Carcinogenicity	HCl is not classifiable as a human carcinogen. No evidence of treatment related carcinogenicity was observed either in other animal studies performed by inhalation, oral or dermal administration. In three industry-based human case studies conducted in the U.S, no association between hydrogen chloride exposure and cancers of the lung, brain, or kidney was observed. In one U.S study of steel-pickling workers an excess risk for cancer of the lung was identified in workers exposed primarily to hydrochloric acid. Under IARC definitions, HCl is not classifiable as to its carcinogenicity to humans (Group 3).
Mutagenicity/ Genotoxicity	In single studies, HCl induced mutation and chromosomal aberrations in mammalian cells and induced chromosomal aberrations in insects and in plants. It did not induce mutation in bacteria. For genetic toxicity, a negative result has been shown in the Ames test. A positive result, which is considered to be an artefact due to the low pH, has been obtained in a chromosome aberration test using Hamster ovary cells. The effects of low pH in in vitro studies are not a problem in vivo as the proton level is regulated systemically. Hydrochloric acid is not considered to be genotoxic.
Reproductive Toxicity Developmental Toxicity/Teratogenicity	No reliable studies have been reported regarding toxicity to reproduction and development in animals after oral, dermal or inhalation exposure to hydrogen chloride/hydrochloric acid. As protons and chloride ions are normal constituents in the body fluid of animal species, low concentrations of hydrogen chloride gas/mist or solution do not seem to cause adverse effects to animals. The cells of gastric glands secrete hydrochloric acid into the cavity of the stomach. No reliable conclusion could be drawn on the potential reproductive toxicity of hydrogen chloride/hydrochloric acid.

Acute Toxicity	Rapid evaporation of the liquid may cause frostbite. The substance is corrosive to the eyes, the skin and the respiratory tract and can cause serious skin burns and blurred/reduced vision or blindness. Inhalation of high concentrations of the gas may cause pneumonitis and lung oedema, resulting in reactive airways dysfunction syndrome. The effects may be delayed. Exposure to hydrochloric acid can produce burns on the skin and mucous membranes, with severity related to the concentration of the solution. Subsequent ulceration may occur, followed by keloid and retractile scarring. Dental decay, including yellowing, softening and breaking of teeth, and related digestive diseases have been recorded after exposures to hydrochloric acid. Mortality has been observed following ingestion of hydrochloric acid. Female rats orally administered 3.3% hydrochloric acid yielded an acute oral median lethal dose (LD50) in a range from 238 to 277 mg/kg bw (Hoechst 1966). No details of the study were available. In another study in rats, administration of a solution of undisclosed concentration induced stomach ulceration, inflammation of the intestine, discolouration of the liver and hyperaemia of the lung (Monsanto 1976). An LD50 of 700 mg/kg bw was reported. An acute dermal LD50 was established as >5010 mg/kg bw in rabbits however the dose levels administered were not reported (Monsanto 1976). Acute median lethal concentration (LC50) values of 8.3 mg/L and 3.2 mg/L were observed in rats and mice respectively after a 30 minute inhalation exposure to aerosolised hydrochloric acid (Darmer et al. 1974).
Irritation	In a skin irritation test in rabbits performed according to OECD TG 404, 37% hydrochloric acid (0.5 mL) was applied by both semi-occlusion and occlusion (Potokar 1985). The chemical was found to be corrosive under both conditions after one hour exposure. Concentrations >17% also caused corrosion in rabbits. Concentrations >3.3% caused skin irritation to rabbits after application for 5 days. Hydrochloric acid caused mild to severe eye irritation in animal studies. There were no data available for respiratory irritation however; inhalation of hydrochloric acid vapours is expected to cause irritation. In humans, the chemical was determined to be 'irritating to skin' (York et al. 1996).
Sensitisation	May cause dermatitis with frequent contact of aqueous solutions of hydrochloric acid.
Health Effects Summary	Hydrochloric acid has demonstrated acute oral toxicity, corrosive effects to the skin and eye, and irritant effects to the respiratory system. Hydrochloric acid is not a skin sensitiser based on the available studies. Only limited information on the repeated oral toxicity of hydrochloric acid is available. However, as the component ions are normal constituents of the human body (particularly the stomach), only localised effects are expected. No systemic effects from repeated exposures are expected. The chemical is not genotoxic. No evidence of treatment-related carcinogenicity was observed in animal studies performed by inhalation or dermal administration. In humans, no association between hydrogen chloride exposure and tumour incidence was observed. No reliable studies were identified regarding specific toxicity to reproduction and development in animals after exposure to hydrochloric acid/hydrogen chloride. Because protons and chloride ions are normal constituents in the body fluids, low concentrations of hydrochloric acid/hydrogen chloride would not be expected to cause adverse reproductive effects to animals. This conclusion is supported by the 90-day inhalation study of hydrogen chloride where no effects on the gonads of rodents were observed.
Key Study/Critical Effect for Screening Criteria	The Australian drinking water guideline value for pH may apply to hydrochloric acid. The critical health effects for risk characterisation include: - local effects (corrosivity); and - systemic acute effect (acute toxicity by the inhalation route of exposure). The critical health effects are different for gaseous hydrogen chloride, for which respiratory irritation and corrosion are critical, and aqueous solutions (hydrochloric acid) where dermal corrosion is the key effect. Due to corrosive nature of the chemical, even low concentrations of the chemical will also cause irritation to the eyes, skin and the respiratory tract.

<table>
<tr><th colspan="2">Ecological Toxicity [1,3,4,8]</th></tr>
<tr><td>Aquatic Toxicity</td><td>The measured acute endpoint for:
Algae = 0.492 mg/L
Daphnia = 0.492 mg/L
Fish = 4.92 mg/L
The measured chronic endpoint for Daphnia is 62 mg/L</td></tr>
<tr><td>Determination of PNEC aquatic</td><td>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 Chronic endpoint of 62 mg/L for Daphnia. The PNECaquatic is 6.2 mg/L.</td></tr>
<tr><th colspan="2">Current Regulatory Controls [1,2,9]</th></tr>
<tr><td>Listed as a Chemical of Concern on International Databases</td><td>
<table>
<tr><th>International Database</th><th>Listed?</th></tr>
<tr><td>European REACH regulation Substances of very high concern (SVHCs) according to Annex XV
https://echa.europa.eu/candidate-list-table</td><td>No</td></tr>
<tr><td>International Agency for Research on Cancer (IARC) as a Group 1, 2A or 2B carcinogen
https://monographs.iarc.who.int/list-of-classifications</td><td>No</td></tr>
<tr><td>National Toxicology Program (NTP) Report on Carcinogens (RoC)
https://ntp.niehs.nih.gov/whatwestudy/assessments/cancer/roc/index.html</td><td>No</td></tr>
<tr><td>US EPA Integrated Risk Information System (IRIS) as carcinogenic to humans, or likely / probable / possibly carcinogenic to humans
EU list chemicals with endocrine disruption listed in Category 1 or Category 2
https://www.epa.gov/iris</td><td>No</td></tr>
<tr><td>United States Endocrine Disrupter Screening Program
https://www.epa.gov/endocrine-disruption/endocrine-disruptor-screening-program-tier-1-screening-determinations-and</td><td>No</td></tr>
<tr><td>Agency for Toxic Substances and Disease Registry (ATSDR) as a neurotoxin
https://wwwn.cdc.gov/TSP/index.aspx?sysid=18</td><td>No</td></tr>
<tr><td>Montreal Protocol
https://www.dcceew.gov.au/environment/protection/ozone/montreal-protocol</td><td>No</td></tr>
<tr><td>Rotterdam Convention
http://www.pic.int/TheConvention/Chemicals/AnnexIIIChemicals</td><td>No</td></tr>
<tr><td>Stockholm Convention
http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx</td><td>No</td></tr>
</table>
</td></tr>
<tr><td>Australian Hazard Classification</td><td>Skin corrosion – category 1B; H314 (Causes severe skin burns and eye damage) STOT SE 3; H335 (May cause respiratory irritation)</td></tr>
<tr><td>Australian Occupational Exposure Standards</td><td>There are no specific exposure standards for hydrochloric acid. However, the permissible exposure limits for hydrogen chloride gas apply (Safe Work Australia 2013): Time Weighted Average (TWA) of 7.5 mg/m^3 (5 ppm).</td></tr>
<tr><td>International Occupational Exposure Standards</td><td>The following exposure standards were identified for hydrogen chloride (Galleria Chemical 2013).
TWA: 7 to 8 mg/m^3 (5 ppm) [Austria, Belgium, Denmark, EU, Hungary, Japan, Korea, Mexico, The Netherlands, New Zealand, Norway, Sweden, Turkey]
2 to 5 mg/m^3 (1-2 ppm) [Germany, Poland, Switzerland, UK].
Short Term Exposure Limit (STEL): 15 mg/m^3 (10 ppm) [Austria, Belgium, EU, Hungary]</td></tr>
<tr><td>Australian Food Standards</td><td>Hydrochloric acid is an additive permitted in accordance with Good Manufacturing Practice (GMP) in processed foods specified in Schedule 1 of the Australia New Zealand Food Standards Code – Standard 1.3.1 – Food Additives (Food Standards Australia New Zealand 2013).</td></tr>
<tr><td>Australian Drinking Water Guidelines</td><td>Hydrochloric acid is listed as an endorsed drinking water treatment chemical in the Australian Drinking Water Guidelines (National Health and Medical Research Council (NHMRC) 2011).</td></tr>
<tr><td>Aquatic Toxicity Guidelines</td><td>No data found</td></tr>
</table>

PBT Assessment	
P/vP Criteria fulfilled?	Hydrochloric acid is an organic salt that dissociates completely to hydrogen and chloride ions in aqueous solutions. Biodegradation is not applicable to these inorganic ions; both hydrogen and chloride ions are also ubiquitous and are present in most water, soil and sediment. Thus, the persistent criteria is not considered applicable to this inorganic salt.
B/vB criteria fulfilled?	Hydrogen and chloride ions are essential to all living organisms and their intracellular and extracellular concentrations are actively regulated. Thus, hydrochloric acid is not expected to bioaccumulate.
T criteria fulfilled?	No chronic toxicity data exist on hydrochloric acid; however, the acute EC(L)50s are >0.1 mg/L in fish, invertebrates and algae. Thus, hydrochloric acid does not meet the screening criteria for toxicity.
Overall conclusion	Not PBT. NICNAS concluded that this chemical poses no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework.

References

1. National Industrial Chemicals Notification and Assessment Scheme (NICNAS). IMAP, Human Health Tier II Assessment for Hydrochloric acid: Retrieved 2020: https://www.nicnas.gov.au
2. National Industrial Chemicals Notification and Assessment Scheme (NICNAS). IMAP, Human Health Tier III Assessment for Hydrochloric acid: Retrieved 2020: https://www.nicnas.gov.au
3. U.S. National Library of Medicine, Toxicology Data Network HSDB (Hazardous Substances Data Bank) http://toxnet.nlm.nih.gov/
4. OECD SIDS. (1992), *UNEP Publications 5; Hydrochloric Acid (IARC Summary & Evaluation, Volume 54*). Obtained from IPCS INCHEM http://www.inchem.org/documents/iarc/vol54/03-hydrochloric-acid.html
5. IARC (International Agency for Research on Cancer). (2011), *Agents Classified by the IARC Monographs, Volumes 1 -102.*
6. IARC (International Agency for Research on Cancer). (1992), *Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man* (Multi-volume work).
7. OECD (2002). IUCLID Data Set for Hydrogen chloride (CAS No. 7647-01-0), UNEP Publications.
8. OECD (2002). Screening Information Dataset (SIDS) Initial Assessment Report for Hydrogen chloride (CAS No. 7647-01-0), UNEP Publications.
9. Safe Work Australia Workplace Exposure Standards for Airborne Contaminants, 2013.
10. Department of the Environment and Energy 2017, National assessment of chemicals associated with coal seam gas extraction in Australia, prepared by the National Industrial Chemicals Notification and Assessment Scheme

Toxicity Summary - Distillates, Hydrotreated Light

Chemical and Physical Properties [1,2,3,4]	
CAS number	64742-47-8
Molecular formula	C48H94
Molecular weight	170 g/mol
Solubility in water	0.009 to 6.45 mg/L (at 25°C)
Melting point	-49 °C
Boiling point	146 to 299 °C
Vapour pressure	1 to 3.7 kPa at 37.8 °C
Henrys law constant	No data found.
Explosive potential	Above 66°C explosive vapour/air mixtures may be formed
Flammability potential	Combustible
Colour/Form	Liquid at room temperature
Overview	Distillates, hydrotreated light (also called deodorised kerosene) is a petroleum substance. The C_9-C_{14} Aliphatic [< 2% Aromatic] Hydrocarbon Solvents Category is comprised of complex aliphatic hydrocarbon solvents that contain >98% aliphatic constituents with carbon numbers in the range of C9-C14 and less than 2% aromatic constituents. The chemical is used as a component of a drilling fluid formulation for coal seam gas extraction.
Environmental Fate[1]	
Soil/Water/Air	Members of the C_9-C_{14} Aliphatic [≤2% aromatics] Hydrocarbon Solvents Category have the potential to volatilize from surface waters, based on Henry's Law constants (HLC) representing volatility for category members that range from 4.76 x 10^4 to 1.67 x 10^6 Pa-m^3/mole (at 25°C). In the air, category members have the potential to rapidly degrade through indirect photolytic processes mediated primarily by hydroxyl radicals (•OH) with calculated degradation half-lives ranging from 0.42 to 1.10 days or 10.8 to 26.4 hours based on a 12-hr day and an •OH concentration of 1.5 x 10^6 •OH/cm^3. These chemicals are unlikely to degrade by hydrolysis as they lack a functional group that is hydrolytically reactive.
Human Health Toxicity Summary [1,2,3]	
Chronic Repeated Dose Toxicity	In a 90-day study conducted in accordance with OECD TG 408, Sprague-Dawley rats were administered deodorized kerosene by gavage at doses of 0, 100, 500 or 1000 mg/kg bw/day (REACH 2013). Microscopic changes, such as incidence of a2µ-globulin, were seen in male kidneys. These effects are not considered relevant to humans. No other treatment-related effects were observed. No Lowest Observed Adverse Effect Level (LOAEL) or No Observed Adverse Effect Level (NOAEL) could be established in this study. Repeated dermal exposures to members of the kerosene/jet fuel category showed minimal systemic effects (API 2010). Animal data on repeat dermal toxicity of kerosene (petroleum) are summarised from REACH (2013) and presented in Table A29.2. The LOAELs and NOAELs are indicated for each study. Prolonged skin exposure to kerosene (petroleum) in rats and rabbits were consistently associated with local irritation. In rabbits only, systemic effects included changes in bodyweight and organ weights. It is expected that deodorized kerosene would have similar effects in the animals. In a 13-week study, rats (strain not specified) were exposed to deodorized kerosene vapour at concentrations of 0, 0.02, 0.048 or 0.10 mg/L for six hours/day, five days/week. No treatment-related effects were reported (REACH 2013).

Carcinogenicity	A study for deodorized kerosene is available in the REACH Dossier (REACH 2013) but was not reported in enough detail to be able to determine the carcinogenicity of the substance. In a study conducted similarly to OECD TG 451, B6C3F1 mice were applied 0, 250 or 500 mg/kg bw/day kerosene (petroleum) in the interscapular region (type of wrapping not specified) for 103 weeks (REACH 2013). At the end of the study, less than 10% decrease in bodyweight gain was observed at the top dose in both sexes. Mortality in females was significantly higher at the two doses compared to controls. Increased incidence and severity of chronic dermatitis was seen in all treatment groups. At the top dose, increased incidence of the following non-neoplastic lesions was reported: amyloid in the liver, kidney, adrenal cortex (males only), spleen; granulocytic hyperplasia in the bone marrow; and hyperplasia of the axillary lymph nodes (females only). The only indication of neoplastic lesions was an increased incidence of malignant lymphomas observed in treated female animals but the values were within the range of historical controls. Under the conditions of the test, kerosene (petroleum) was not carcinogenic. The LOAEL for systemic effects is 250 mg/kg bw/day. The International Agency for Research on Cancer (IARC) concluded that there is inadequate evidence for the carcinogenicity of kerosene (petroleum) in experimental animals and humans, placing the chemical in Group 3 (Not classifiable as to its carcinogenicity to humans) (IARC 1989). Deodorized kerosene is not carcinogenic, based on reading across the information available for kerosene (petroleum).
Mutagenicity/ Genotoxicity	In vitro tests reported deodorized kerosene as negative both with and without metabolic activation in Ames tests conducted in accordance with OECD TG 471 (REACH 2013; OECD 2011) and in chromosomal aberration tests conducted in accordance with OECD TG 473 (OECD 2011, 2012). In an in vivo study, deodorized kerosene was negative in a dominant lethal assay, conducted in accordance with OECD TG 478, in male Swiss mice and Long Evans rats administered 10% deodorized kerosene intraperitoneally (REACH 2013). These studies demonstrate that deodorized kerosene is not genotoxic.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	C9-C14 aliphatic (≤2% aromatic) hydrocarbon solvents and C14-C20 aliphatic (≤2% aromatic) hydrocarbon solvents are not toxic to fertility (OECD 2011, 2012). Members of the kerosene/jet fuel category are not toxic to fertility (API 2010). Sprague-Dawley rats were administered undiluted kerosene (petroleum) by gavage at doses of 0, 750, 1500 or 3000 mg/kg bw/day in males treated for 70-90 days and 0, 325, 750 or 1500 mg/kg bw/day in females treated for 21 weeks. At 750 and 1500 mg/kg bw/day, increased absolute liver weight was observed in females but with no corresponding changes in clinical chemistry or histopathology. In females only, other effects included perianal dermatitis at 1500 mg/kg bw/day and stomach hyperplasia at 750 and 1500 mg/kg bw/day. These parameters were not measured in males. In males, the study indicated dose dependent decrease in male bodyweight that was linked to nephropathy specific to male rats. Data for this effect were not provided in the study description. There were no treatment related effects on fertility in both sexes (REACH 2013). The NOAEL for systemic effects in females only was 325 mg/kg bw/day. No NOAEL can be established for fertility effects. C9-C14 aliphatic (≤2% aromatic) hydrocarbon solvents and C14-C20 aliphatic (≤2% aromatic) hydrocarbon solvents are not developmental toxicants (OECD 2011, 2012). Members of the kerosene/jet fuel category are not developmental toxicants (API 2010). In a study conducted in accordance with OECD TG 414, Sprague-Dawley rats were administered kerosene (petroleum) by gavage on gestation days (GD) 6 to 15 at doses of 0, 500, 1000, 1500 or 2000 mg/kg bw/day (REACH 2013). Bodyweight gain was decreased at 1500 and 2000 mg/kg bw/day. Foetal weight was decreased at 1500 and 2000 mg/kg bw/day which may be attributed to decreased maternal bodyweight gain. No malformations were reported. The maternal NOAEL is 1000 mg/kg bw/day. In another study, Sprague-Dawley rats were exposed (whole body) to kerosene (petroleum) in air at concentrations of 0, 106 or 364 ppm on GD 6-15. There were no treatment-related effects observed in the dams and offspring (REACH 2013).

	Deodorized kerosene is not considered a developmental toxicant, based on reading across data available for kerosene (petroleum).
Acute Toxicity	The chemicals have low acute toxicity based on results from animal tests following oral exposure. The median lethal dose (LD50) in rats is >2000 mg/kg bw (OECD, 2011; US EPA, 2011; OECD, 2012a; OECD, 2012b; OECD, 2012c). The chemicals have low acute toxicity based on results from animal tests following dermal exposure. The LD50 in rats and rabbits is >2000 mg/kg bw (OECD, 2011; US EPA, 2011; OECD, 2012a; OECD, 2012b; OECD, 2012c). The chemicals have low acute toxicity based on results from animal tests following inhalation exposure.
Irritation	Semi-occlusive applications of commercial grade deodorized kerosene produced slight irritation in New Zealand White and SPF rabbits in dermal irritation studies conducted in accordance with OECD TG 404. The studies reported the range of erythema and oedema scores to be 0.3-0.9 and 0.2-1.0, respectively, based on Draize scoring at 24, 48 and 72 hours. Deodorized kerosene is slightly irritating to rabbit skin. Several studies conducted similarly to OECD TG 405 showed minimal effects to the eye with the reported range of conjunctival redness score to be 0-0.2 from instillation of undiluted deodorized kerosene in the eyes of New Zealand White and SPF rabbits (OECD 2011). Deodorized kerosene is slightly irritating to rabbit eye.
Sensitisation	The C9-C14 aliphatic (≤2% aromatics) Category members do not cause skin sensitization.
Health Effects Summary	Deodorised kerosene is an aspiration hazard since it has low viscosity and is composed of aliphatic and aromatic hydrocarbons up to 10%. Deodorised kerosene has low acute oral, dermal and inhalation toxicity, and is slightly irritating to the skin and eyes. The substance is not a skin sensitiser, based on reading across data available for kerosene (petroleum). No treatment-related effects were reported in repeated oral and inhalation exposures to deodorised kerosene. Prolonged dermal exposure to kerosene (petroleum) reported local irritation in rats and rabbits, and changes in bodyweight and organ weights in rabbits. It is expected that these effects would be similar for deodorised kerosene. Based on the absence of adverse effects observed in repeat dose toxicity studies, for the purposes of quantifying the health risk to the general worker, the highest dose tested in the study conducted in rats (1 000 mg/kg bw/day) is used in this risk assessment. The substance is not genotoxic. It is neither a carcinogen nor a reproductive toxicant, based on reading across data available for kerosene (petroleum).
Key Study/Critical Effect for Screening Criteria	The most appropriate No-Observed-Adverse-Effect Level (NOAEL) for risk assessment is 1 000 mg/kg bw/day based on maternal toxicity (decreased bodyweight gain) at the Lowest- Observed-Adverse-Effect Level (LOAEL) of 1500 mg/kg bw/day from a developmental toxicity study on kerosene (petroleum).
Ecological Toxicity [2]	
Aquatic Toxicity	Lowest acute endpoint for Daphnia = 0.018 mg/L (modelled)
Determination of PNEC aquatic	Based on the lowest acute endpoint for Daphnia (0.018 mg/L), an assessment factor of 100 has been applied, resulting in a PNECaquatic of 1.80E-04 mg/L.
Current Regulatory Controls [2]	
Australian Hazard Classification	All of the chemicals are classified as hazardous, with the following risk phrase for human health in the Hazardous Substances Information System (HSIS) (Safe Work Australia): Xn; R65 (acute toxicity) Mixtures containing the substance are classified as hazardous with the following risk phrase based on the concentration (Conc) of the substance in the mixtures: Conc ≥10%: Xn; R65 (May cause lung damage if swallowed)
Australian Occupational Exposure Standards	No specific exposure standards are available.

International Occupational Exposure Standards	No specific exposure standards are available for this chemical.
Australian Food Standards	No data available.
Australian Drinking Water Guidelines	No data available.
Aquatic Toxicity Guidelines	Oils and greases (including petrochemicals) for freshwater production: <300[6] µg/L (ANZECC 2000)
PBT Assessment[1,2]	
P/vP Criteria fulfilled?	No. This chemical is expected to be biodegradable.
B/vB criteria fulfilled?	Yes. This substance has a potential to bioaccumulate, based on calculated log BCF values for constituents that range from 2.78 to 4.06, and calculated BCF values of 598 to 11,430 L/kg wet-weight, based on the Arnot and Gobas model, that take into account biotransformation of the chemicals in fish tissue. This chemical also has a log Kow of 6.025.
T criteria fulfilled?	Yes. The lowest acute endpoint is <1 mg/L.
Overall conclusion	Not PBT. Potentially B and T.

References

1. OECD (2012) SIDS Initial Assessment Profile on C_9-C_{14} Aliphatic [≤2% aromatic] Hydrocarbon Solvents Category. Available at: http://webnet.oecd.org/HPV/UI/SIDS_Details.aspx?id=476560b6-e2b7-4466-9c52-0b278c8b71a7
2. National Industrial Chemicals Notification and Assessment Scheme (NICNAS, 2017). National assessment of chemicals associated with coal seam gas extraction in Australia. Human health hazards of chemicals associated with coal seam gas extraction in Australia.
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6. ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality for protection for aquatic ecosystems

Toxicity Summary - Didecyldimethyl ammonium chloride

Chemical and Physical Properties [1,2,3]	
CAS number	7173-51-5
Molecular formula	$C_{22}H_{48}NCl$
Molecular weight	362.08 g/mol
Solubility in water	0.39 g/L at 25 °C
Density	0.87 to 0.902 kg/L at 20 °C
Melting point	94 °C
Boiling point	No boiling point at atmospheric pressure (1013 hPa). It decomposes before boiling at a temperature of >180 °C.
Vapour pressure	6.0×10^{-6} kPa at 25 °C
Henrys law constant	8.5×10^{-7} Pa m³/mol
Explosive potential	Non-explosive
Flammability potential	Flammable
Colour/Form	Solid powder/particulate of white or slight yellowish colour with a moderate mushroom-like odour.
Overview	This chemical is categorised as a cationic quaternary ammonium surfactant with reported cosmetic use, home maintenance use, and industrial use. Industrially it is used in oil and gas field drilling and production operations; paper industry processing; in washing, cleaning and disinfecting products; and for water treatment. It is also used in consumer cleaning and washing products as well as biocides. The main route of public exposure is expected to be through the skin and eyes, inhalation from products applied as cosmetics and from using domestic products.
Environmental Fate [2]	
Soil/Water/Air	If discharged into natural waters, the chemical is expected to dissociate and release its quaternary ammonium cations, which can can adsorb to clays and natural organic materials, such as humic substances and remain in soil. It is not expected to undergo long-range transport based on low volatility its biodegradability in the environment. This chemical has low to moderate bioaccumulation potential in aquatic organisms. Reported bioconcentration factor (BCF) in the fish *Cyprinus carpio* is 63 L/kg at a test concentration of 0.005 mg/L and in the range of 47 to 95 L/kg at a test concentration of 0.0005 mg/L.
Human Health Toxicity Summary [1,3,4,5]	
Chronic Repeated Dose Toxicity	In a repeated dose oral toxicity study, didecyl dimethyl ammonium chloride (CAS No. 7173-51-5) was administered to rats (10/sex/dose) in the diet at 0, 6.2, 18.5, 36.8, 60.7 and 175.4 mg/kg bw/day for males and 0, 7.5, 22.3, 44.4, 74.3 and 225.5 mg/kg bw/day for females for 13 weeks. High-dose animals showed increased mortality; decreased mean body weights, body weight gain, and food consumption; and increased incidence of gross pathological observations and non-neoplastic lesions, including higher incidence of glycogen depletion in the liver and contracted spleens. Sinus erythrocytosis and lymphoid hyperplasia of mesenteric lymph nodes were also noted in high-dose females. The NOAEL was established as 60.7 mg/kg bw/day and 74.3 mg/kg bw/day in males and females, respectively, based on increased mortality and effects on body weights, liver and spleen at the next highest dose. In another combined chronic toxicity/carcinogenicity study, didecyl dimethyl ammonium chloride (CAS No. 7173-51-5) was administered to SD rats (60/sex/dose) in the diet at approximately 0, 13, 32 or 64 mg/kg bw/day for males and 0, 16, 41 or 83 mg/kg bw/day for females for two years (see Carcinogenicity). Treatment-related effects in the high-dose

	animals included decreased mean body weight, increased incidence of sinusoidal blood, haemosiderosis, and histiocytosis in the mesenteric lymph nodes (US EPA, 2008). In a repeated dose oral toxicity study, didecyl dimethyl ammonium chloride (CAS No. 7173-51-5) was administered to CD-1 mice (60/sex/dose) in the diet at 0, 100, 500 or 1000 ppm (approximately 0, 15.0, 76.3 or 155.5 mg/kg bw day for males and 0, 18.6, 93.1 or 193.1 mg/kg bw/day for females) for 78 weeks. Decreased mean body weights and body weight gains were the only treatment-related effects noted at the highest tested dose. The NOAEL was established as 76.3/93.1 mg/kg bw/day for males/females (US EPA, 2008). In a chronic, 1-year toxicity study (Schulze, G 1991), males and female beagle dogs were administered DDAC (80.8% a.i.) at dosage levels of 0, 3, 10 and 20/30 mg/kg/day (dosing at 30 mg/kg/day was not tolerated well and was discontinued on day 31; dosing was resumed at day 36 at 20mg/kg/day). No treatment-related deaths occurred during the study. The treatment-related clinical signs (soft/mucoid feces, emesis) were observed frequently in high-dose animals. Hematology or urinalysis results were normal. Total cholesterol levels were significantly decreased in high-dose females. Gross and histopathological findings did not reveal any treatment-related effects. Based on increased incidence of clinical observations (emesis and soft/mucoid feces) in males and females and decreased total cholesterol levels in females, the NOAEL for both male and females is 10 mg/kg/day, and the LOAEL is 20 mg/kg/day (USEPA 2017).
Carcinogenicity	The chemical is not likely to be a carcinogen. When administered to SD rats (60/sex/dose) in the diet at up to 64 mg/kg bw/day for males and 83 mg/kg bw/day for females for two years in a combined chronic toxicity/carcinogenicity study, there was no evidence of carcinogenicity even though the maximum tolerated dose was achieved in this study for carcinogenicity testing (based on a decrease in mean body weight and some histopathological changes). In a similar study, when administered to CD-1 mice (60/sex/dose) in the diet at up to 76.3 or 155.5 mg/kg bw/day for males and 193.1 mg/kg bw/day for females for 78 weeks, treatment-related mortality or clinical signs, and gross and histopathological abnormalities were not observed, and there was no evidence of carcinogenicity. Carcinogenicity was also not seen in another study where SD rats were fed this chemical at up to 55.4 mg/kg bw/day for males and 69.5 mg/kg bw/day for females for 104 weeks.
Mutagenicity/ Genotoxicity	This chemical was not mutagenic in bacterial reverse mutation assays and did not induce chromosomal aberrations in Chinese hamster ovary cells. Although data are limited for cationic quaternary ammonium surfactants, the available information indicates this chemical is not considered to have mutagenic or genotoxic potential.
Reproductive Toxicity / Developmental Toxicity/ Teratogenicity	This chemical is not considered to have specific reproductive and developmental toxicity; any reproductive and developmental effects were only observed secondary to maternal toxicity. When administered to pregnant New Zealand White rabbits (16/dose) in a developmental toxicity study by gavage at 0 - 10 mg/kg bw/day, maternal toxicity was evident at the mid and high doses. An increased maternal mortality was noted at 10 mg/kg bw/day. Developmental effects were noted at 10 mg/kg bw/day. The NOAEL for maternal toxicity was established as 1 mg/kg bw/day (based on decreased body weight gain, hypoactivity, laboured/audible respiration, and mortality) and the NOAEL for developmental toxicity was established as 3 mg/kg bw/day (based on increased mortality, decreased foetal body weight, and an increased number of dead foetuses). In another developmental toxicity study, when administered to pregnant SD rats (25/dose) by gavage at doses of 0, 1, 10 and 20 mg/kg bw/day, the NOAEL for maternal toxicity was established as 1 mg/kg bw/day (based on decreased body weight gain, low food efficiency, and audible respiration) and the NOAEL for developmental toxicity was established as 10 mg/kg bw/day (based on an increased incidence of skeletal variations at the next higher dose).
Acute Toxicity	<u>Oral</u> The chemical has moderate acute toxicity following oral exposure in animal tests. The reported oral median lethal dose (LD50) in rats was 238–262 mg/kg bw for didecyl dimethyl ammonium chloride (CAS No. 7173-51-5) <u>Dermal</u>

	The chemical is likely to have low to moderate acute dermal toxicity in animal tests. The reported dermal median lethal dose (LD50) in rats was >1000 mg/kg bw (undiluted) for didecyl dimethyl ammonium chloride (CAS No. 7173-51-5) (65 % purity).
Irritation	This chemical is considered to be corrosive to skin and eyes. No data are available on skin irritation in animals and. Although data on eye irritation is limited, the corrosive nature of this chemical affects the eyes.
Sensitisation	Based on limited information available on the skin sensitisation potential of this chemical, it is not likely to be a skin sensitiser.
Health Effects Summary	The results from the studies reveal a pattern of response (local irritation/corrosion followed by reduced food intake and reduction in body weight and body weight gain) that is consistent with the mode of action of a corrosive substance. Therefore, the systemic effects observed in these studies are regarded as secondary to the local irritation/corrosion caused by DDAC.
Key Study/Critical Effect for Screening Criteria	For the purpose of this risk assessment, the most NOAEL for risk assessment is 10 mg/kg bw/day based on the chronic oral toxicity study in dogs and using an uncertainty factor of 100 (10x inter-species extrapolation, 10x intra-species variation.
Ecological Toxicity [2]	
Aquatic Toxicity	Acute: Fish: 96 h LC50 = 0.19 mg/L, Lepomis macrochirus (Bluegill) Invertebrates: 48 h LC50 = 0.018 mg/L, Daphnia magna Algae: 96 h EC50 = 0.014 mg/L, Pseudokirchneriella subcapitata (Green algae) Chronic: Invertebrates: 21 d NOEC = 0.125 mg/L, Daphnia magna Algae: 72 h NOEC = 0.06 mg/L, Pseudokirchneriella subcapitata (Green algae)
Determination of PNEC aquatic	The calculated PNEC for di-alkyl quaternary ammonium compounds with C_{10} alkyl chains is 2.8 µg/L based on a 96 h EC50 of 0.014 mg/L for algae. The laboratory endpoint value for algae was divided by an assessment factor of 100 to account for interspecies variation and the use of acute toxicity endpoint values, and the derived value was then multiplied by a factor of 20 to account for the 5% bioavailable fraction in environmental waters.
Current Regulatory Controls	
Listed as a Chemical of Concern on International Databases	

International Database	Listed?
European REACH regulation Substances of very high concern (SVHCs) according to Annex XV https://echa.europa.eu/candidate-list-table	No
International Agency for Research on Cancer (IARC) as a Group 1, 2A or 2B carcinogen https://monographs.iarc.who.int/list-of-classifications	No
National Toxicology Program (NTP) Report on Carcinogens (RoC) https://ntp.niehs.nih.gov/whatwestudy/assessments/cancer/roc/index.html	No
US EPA Integrated Risk Information System (IRIS) as carcinogenic to humans, or likely / probable / possibly carcinogenic to humans EU list chemicals with endocrine disruption listed in Category 1 or Category 2 https://www.epa.gov/iris	No
United States Endocrine Disrupter Screening Program https://www.epa.gov/endocrine-disruption/endocrine-disruptor-screening-program-tier-1-screening-determinations-and	No
Agency for Toxic Substances and Disease Registry (ATSDR) as a neurotoxin https://wwwn.cdc.gov/TSP/index.aspx?sysid=18	No
Montreal Protocol https://www.dcceew.gov.au/environment/protection/ozone/montreal-protocol	No
Rotterdam Convention http://www.pic.int/TheConvention/Chemicals/AnnexIIIChemicals	No

	Stockholm Convention http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx	No
Australian Hazard Classification	This chemical is classified as hazardous in Safe Work Australia HCIS. • Hazard categories include: - Acute toxicity – Category 4 - Skin corrosion – Category 1B • Hazard statements include: - H302 (Harmful if swallowed) - H312 (Harmful in contact with skin) - H314 (Causes severe skin burns and eye damage)	
Australian Occupational Exposure Standards	No Australian occupational exposure standards are provided by Safe Work Australia HCIS for this chemical.	
International Occupational Exposure Standards	No exposure standards provided in NIOSH.	
Australian Food Standards	No Australian food standards were identified in FSANZ	
Australian Drinking Water Guidelines	No aesthetic or health-related guidance values were identified in the National Health and Medical Research Council (NHMRC) Australian Drinking Water Guidelines (NHMRC, 2022).	
Aquatic Toxicity Guidelines	No Australian guidelines available.	
PBT Assessment [2]		
P/vP Criteria fulfilled?	No. Based on biodegradation studies, this chemical is categorised as Not Persistent.	
B/vB criteria fulfilled?	No. Based on the available measured bioconcentration data, all chemicals in this group are categorised as Not Bioaccumulative.	
T criteria fulfilled?	Yes. Based on available acute ecotoxicity values below 1 mg/L and/or chronic ecotoxicity values below 0.1 mg/L, this chemical is categorised as Toxic.	
Overall conclusion	Overall, this chemical is not considered to be a PBT substance.	

Notes: *HCIS – Hazardous Chemical Information System; NIOSH – National Institute for Occupational Safety and Health; FSANZ – Food Standards Australia New Zealand; NHMRC (2022) – National Health and Medical research Council, Australian Drinking Water Guidelines 6, 2011 (Version 3.8, Updated September 2022)*

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3. ECHA, https://echa.europa.eu/registration-dossier/-/registered-dossier/5864
4. USEPA (2006) Reregistration Eligibility Decision for Aliphatic Alkyl Quaternaries (DDAC), August 2006
5. USEPA (2017) Didecyl Dimethyl Ammonium Chloride (DDAC) Final Work Plan, March 2017

Toxicity Summary - Glutaraldehyde

Chemical and Physical Properties [1,2,3]	
CAS number	111-30-8
Molecular formula	C5H8O2
Molecular weight	100.11
Solubility in water	Soluble in all proportions in water and ethanol; soluble in benzene and ether.
Melting point	-14°C
Boiling point	188°C
Vapour pressure	2.03 x 10^{-3} kPa at 25 °C (50% solution)
Henrys law constant	0.011 Pa m^3/mol at 25 °C
Explosive potential	Non explosive
Flammability potential	Non flammable
Colour/Form	Colourless oily liquid. In the vapour state, glutaraldehyde has a pungent odour, with an odour threshold of 0.04 ppm.
Overview	Glutaraldehyde is manufactured in Germany by BASF and in the USA by Union Carbide Corporation. It is usually sold commercially as a 45% or 50% aqueous solution. Glutaraldehyde has a wide variety of uses throughout the world with its use spread over a number of different industries. It is used primarily as a biocide but it also has wide use as a fixative, and some use as a therapeutic agent. The principal health effects of glutaraldehyde are irritation of the skin, eye and respiratory tract, skin sensitisation and occupational asthma. Exposure data indicated that, in some situations, particularly the health care industry (disinfection), x-ray film processing and the animal health industry (spray use), health concerns may arise where available control measures such as ventilation have not been implemented to minimise exposure. Due to low and intermittent exposure, the public health risk from the industrial use of glutaraldehyde is minimal. For the use of glutaraldehyde in cosmetics, a safety margin of >400 for extensive use indicated low concern.
Environmental Fate[1]	
Soil/Water/Air	Glutaraldehyde is a hydrophilic substance that will be mainly associated with the aquatic compartment, with minor amounts partitioning to the atmosphere, following release to the environment. Hydrolysis is slow, but glutaraldehyde, like other aldehydes, undergoes aerial oxidation in solution. It biodegrades rapidly in aerobic and anaerobic aquatic environments at subcidal concentrations (below 10 mg/L) and will not bioaccumulate. Tropospheric degradation is also rapid.
Human Health Toxicity Summary [1,2,3,7]	
Chronic Repeated Dose Toxicity	A two-year chronic study was conducted in male and female Fischer 344 rats (NICNAS 1994). Groups of 100 male and 100 female rats were administered 0, 50, 250, or 1000 ppm w/v glutaraldehyde in drinking water (4, 17 and 64 mg/kg bw/day for the males and 6, 25 and 86 mg/kg/day for the females). The mortality rate over the treatment period was 25 to 30% for males and 19 to 23% for females with no dose-related increase. The major cause of death in all rats (control and dose groups) was large granular cell lymphatic leukaemia (LGLL). Small dose-related decreases in absolute body weight and body weight gain occurred at 250 and 1000 ppm in males and at 1000 ppm in females. Dose-related decrease in urine volumes and associated increase in osmolality were observed in higher dose animals. At necropsy at 52, 78 and 104 weeks, the only statistically significant changes in organ weights were for the kidney. Relative kidney weights were increased for males and females at 52 and 78 weeks. A significant dose-related increase in kidney weight relative to final body weight occurred for males and females in the 250 and 1000 ppm groups, including an increase in absolute kidney weight for the female rats. Changes in final body

	weights and the weights of other organs were minor and / or sporadic and were unlikely to be related to glutaraldehyde exposure. The total leucocyte count was significantly increased at week 104 in males at 250 and 1000 ppm, and in females at 250 ppm only. The variation in counts was large, possibly due to the large monocyte count at 250 and 1000 ppm. Changes in clinical chemistry parameters included decreases in the activities of some enzymes at 250 and 1000 ppm and occasional decreases in total protein, globulin and phosphorous; these were probably due to reduced food consumption and body weight. Gross pathology showed evidence of gastric inflammation, particularly in rats sacrificed at the end of the study, with irritation observed as ulceration, a multifocal colour change and thickening of the mucosa (dose groups not specified). Histologic examination of the tissues revealed squamous epithelial hyperplasia and keratinised cysts and oedema. Based on the observations, a NOAEL of 4 mg/kg bw/day for males and 6 mg/kg bw/day for females was established in this study. For the purpose of human health risk assessment, the lowest NOAEL (4 mg/kg bw/day) established in the two-year chronic study in rats will be used.
Carcinogenicity	In a two-year chronic/carcinogenicity study by Van Miller et al. (2002), groups of 100 male and 100 female Fischer 344 rats were treated with 0, 50, 250, or 1000 ppm w/v glutaraldehyde in drinking water. The mean glutaraldehyde consumption for each of the three groups was 4, 17 and 64 mg/kg bw/day for the males and 6, 25 and 86 mg/kg bw/day for the females. The mortality rate during the study period was 25 to 30% for males and 19 to 23% for females and was not dose-related. Gross pathology showed evidence of gastric inflammation. The main finding of the study was an increased incidence of large granular lymphocytic leukaemia (LGLL) in the spleen and liver of male and female rats in all groups, including the control group. Treated females showed a significantly increased incidence of LGLL and analysis for dose-response trend for the severity of LLGL revealed an increased severity in females at the higher dosages (53% in spleen and 54% in liver versus respectively 20% and 23% in untreated females) while no such observation were made for the males. No other significant oncogenic effects were observed during the study. Occurrence of LGLL was seen in all groups including controls; the incidence of LGLL in the 1000 ppm group was high compared to controls but no clear dose-response relationship was evident, and LGLL mainly affected treated females whereas the incidence in treated males was within the control range (REACH 2013). Historical control data for untreated Fischer 344 rats in NTP studies also indicates that the ranges for this tumour are 10 to 72% in males and 6 to 31% in females (REACH 2013). The control data in the Van Miller et al. study fitted in with the historical control data reported from NTP studies. The variability in control data for LGLL and the wide variation reported in the literature makes a definitive conclusion difficult. Base on this study, glutaraldehyde was considered not to be carcinogenic.
Mutagenicity/ Genotoxicity	Glutaraldehyde has been extensively tested for genetic activity in vitro and in vivo, however there is disagreement in the literature regarding glutaraldehyde's genetic activity (Zeiger et al. 2005). While all in vivo genotoxicity tests with glutaraldehyde gave negative results, mixed results were reported for in vitro mutagenicity tests. Early in vitro tests were negative (Watts 1984), but some recent bacterial assays and tests in mammalian cells indicated that glutaraldehyde could be mutagenic in vitro. A series of reverse mutation assays was carried out with various Salmonella typhimurium strains, with and without metabolic activation (REACH 2013). All assays with TA 100, 1535, 1537 and 98 were negative. Some assays with TA 102 and 104 gave positive results. Tests with Escherichia coli also yielded both positive as well as negative results. Glutaraldehyde induced sister chromatid exchanges in CHO cells with and without S9 metabolic activation in one laboratory, but was negative without S9 and only weakly positive with S9 in the second laboratory (NICNAS 1994). The difference in the results was attributed to slight differences between the data evaluation systems used in the two laboratories. Glutaraldehyde was not mutagenic in any of the in vivo assays such as peripheral blood micronucleus test, rat bone marrow chromosomal aberration assay and the Drosophila melanogaster sex-linked recessive lethal test (NICNAS 1994; REACH

	2013). Chromosome aberrations in bone marrow cells were reported in only one out of eight studies using rats and mice, micronuclei were not induced in bone marrow cells of mice, and dominant lethal mutations were not induced in mice. Glutaraldehyde did not induce cell transformation in Syrian hamster embryo cells in vitro (Zeiger et al. 2005). In vivo, inhalation of glutaraldehyde induced cell proliferation in nasal tissue in rats and mice, but did not induce DNA damage at these sites. Based on these observations, it is concluded that glutaraldehyde is not a genotoxin.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	Studies on the incidence of miscarriage in pregnant women have shown no difference between those exposed to glutaraldehyde and those not exposed to the chemical. Studies in female rats and mice have resulted in embryotoxicity/foetotoxicity for glutaraldehyde, but only at doses which are maternally toxic. A number of studies have found no evidence of teratogenicity.
Acute Toxicity	Several acute oral toxicity studies with glutaraldehyde have been reported in rats and other species. In one reliable study, administration of 0.2, 0.3, 0.5, 1.0, 1.7 mL/kg bw glutaraldehyde (corresponding to 226, 339, 565, 1130 and 1921 mg/kg bw, respectively) to male/female Wistar rats by gavage gave a median lethal dose (LD50) of 226 mg/kg bw (REACH 2013). Necropsy of animals that died during the observation period revealed congestion of the lungs and the abdominal viscera. In another study in Sprague-Dawley rats, the oral LD50 was 316 mg/kg bw for males and 285 mg/kg bw for females, when 10 mL of 2.15, 3.16, 4.64, 14.7% glutaraldehyde (corresponding to 215, 316, 464 and 1470 mg/kg bw) was administered by oral gavage (REACH 2013). In a separate study using different strengths of glutaraldehyde, Ballantyne (1986) showed that the oral LD50 for glutaraldehyde in rats varied with the concentration of the glutaraldehyde used. By using different concentrations of glutaraldehyde solutions (1% to 50%) and varying the administration volume to maintain a constant dose, oral LD50 in the range 66 to 733 mg/kg bw were obtained. These studies indicate that glutaraldehyde has high acute oral toxicity. Of the 18 acute dermal toxicity studies reported in REACH (2013) dossiers, results from 14 studies indicated LD50 higher than 2000 mg/kg bw. In four other studies, LD50 ranged between 250 and 1432 mg/kg bw. These studies however did not follow international guidelines and have low reliability. Based on these studies, glutaraldehyde is considered to have low acute dermal toxicity. In a well-defined study, 10 male and 10 female Sprague-Dawley rats per dose group were exposed to glutaraldehyde as liquid aerosol at 0.22, 0.31 and 0.63 mg/L for 4 hours (REACH 2013). Exposure was followed by an observation period of 14 days. During the exposure period slight nasal discharge, snout wiping, flank respiration and irregular to intermittent respiration were reported in rats. During the post-exposure period, bloody nasal discharge, red crusts surrounding the nose, whooping or gasping respiration with rasping sounds and a tremulous gait were observed. These symptoms disappeared in the surviving animals within 5 to 9 days post-exposure. Mortalities were noted in all treated groups. The determination of the LC50 values was based on the Probit Analysis. An LC50 of 0.48 mg/L was calculated for both male and female rats. In another acute inhalation study conducted in a similar manner to the above study, Sprague-Dawley rats, 10 rats per sex per dose group, were exposed to 0.1, 0.18, 0.28, 0.39 and 0.44 mg/L glutaraldehyde as liquid aerosol for 4 hours (REACH 2013). During and after exposure, mortality and clinical signs of toxicity were recorded at regular time intervals. The LC50 in this study was established as 0.28 mg/L for females and 0.39 mg/L for males. Based on the above studies, glutaraldehyde is considered to have high acute inhalation toxicity.
Irritation	Glutaraldehyde is corrosive to the skin and eyes of rabbits at high concentrations, with signs of skin irritation evident at 2%, and eye irritation at 0.2%. Exposure to glutaraldehyde vapours in acute inhalational studies resulted in nasal irritation and respiratory difficulties. Joint irritation was seen in rabbits after intra-articular administration.
Sensitisation	The skin sensitisation effect of glutaraldehyde was demonstrated in tests with guinea pigs.
Health Effects Summary	Glutaraldehyde has high acute oral and inhalation toxicity and low to moderate acute dermal toxicity. Based on human and animal data, it is corrosive, the vapours are irritating to the respiratory tract, and it has skin and respiratory sensitisation potential. Glutaraldehyde has high repeat dose oral and inhalation toxicity, with an oral No-Observed-Adverse-Effect Level (NOAEL) of 4 mg/kg

	bw/day based on changes in liver and kidney weights and clinical chemistry parameters. Glutaraldehyde is not genotoxic or carcinogenic. It did not have any adverse effects on the reproductive system of adult rats or on the development of foetuses. The critical adverse health effects of glutaraldehyde are corrosivity, skin and respiratory tract sensitisation and acute and repeat dose oral and inhalation toxicity.
Key Study/Critical Effect for Screening Criteria	From the hazard characterisation, the critical (most sensitive) adverse health effects for repeated exposures to the chemical are changes in clinical chemistry parameters and relative organ (liver and kidney) weights. Glutaraldehyde has high repeat dose oral toxicity with an oral NOAEL of 4 mg/kg bw/day. This NOAEL is used in this human health risk assessment. Uncertainty factors: 10 (interspecies variability); 10 (intraspecies variability) Oral RfD = 4/100 = 0.04 mg/kg/dayDrinking water guideline value = 0.156 mg/L It is noted that ATSDR (2017) reports a chronic minimal risk level (MRL) of 0.1 mg/kg/day for glutaraldehyde which is based on the same NOAEL of 4 mg/kg bw/day using a less conservative safety factor.
Ecological Toxicity [1,2,3,4]	
Aquatic Toxicity	96 h acute Bluegill sunfish LC50 = 11.2 mg/L 48 h acute Oyster larvae LC550 = 2.1 mg/L 96 h acute Green crabs LC50 = 465 mg/L 96 h acute Grass shrimp LC50 = 41 mg/L 48 acute Daphnia magna LC50 = 0.35 mg/L 48 acute Daphnia magna LC50 = 16.3 mg/L 21 d reproduction Daphnia magna LOEC = 4.3 mg/L, NOEC = 2.1 mg/L 96 h algal growth inhibition Selenastrum capricornutum ILm = 3.9 mg/L (median inhibitory limit) 96 h algal growth inhibition Scenedesmus subspicatus EC50 = 1.0 mg/L Bacterial inhibition Sewage microbes IC50 = 25-34 mg/L In summary, the test results indicate that glutaraldehyde is slightly to moderately toxic to aquatic fauna and moderately to highly toxic to algae. In some instances, glutaraldehyde appeared to be rapidly lost from test waters in the laboratory. Such behaviour in aquatic toxicity tests generally means that their results will underestimate the inherent toxicity of a substance. However, the toxicity that will prevail under environmental conditions is likely to be lower than that recorded in the laboratory in view of the rapid degradation that would be expected to occur in natural surface waters.
Determination of PNEC aquatic	As a wide selection of species is available, applying a safety factor of 10 to the NOEC (2.1 mg/L) derived from Daphnia seems most appropriate, giving a PNEC of 2100/10 = 0.21 mg/L.
Current Regulatory Controls [1,2,4]	
Australian Hazard Classification	Glutaraldehyde is classified as hazardous in the Hazardous Substances Information System (HSIS) with the following risk phrase (Safe Work Australia 2013): · T (Toxic); R23/25 (Toxic by inhalation and if swallowed) · C (Corrosive ; R34 (causes burns) · R42/43 (May cause sensitisation by inhalation and skin contact). Mixtures containing the chemical are classified as hazardous with the following risk phrases based on the concentration (Conc) of the chemical in the mixtures. The risk phrases for this chemical are: · Conc ≥50%: T; R23/25; R34; R42/43 (Toxic; toxic by inhalation and if swallowed; causes burns; may cause sensitisation by inhalation and skin contact) · ≥25% Conc <50%: T; R23; R22; R34; R42/43 (Toxic; toxic by inhalation, harmful if swallowed, causes burns; may cause sensitisation by inhalation and skin contact) · ≥10% Conc <25%: C; R20/22; R34; 42/43 (Corrosive; harmful by inhalation and if

	swallowed; causes burns; may cause sensitisation by inhalation and skin contact) · ≥2% Conc <10%: Xn; R20/22; R37/38; R41; R42/43 (Harmful; harmful by inhalation and if swallowed; irritating to respiratory system and skin; risk of serious eye damage; may cause sensitisation by inhalation and skin contact) · ≥1% Conc <2%: Xn; R36/37/38 R42/43 (Harmful; Irritating to eyes, respiratory system and skin; may cause sensitisation by inhalation and skin contact) · ≥0.5% Conc <1%: Xi; R36/37/38; R43 (Irritating; irritating to eyes, respiratory system and skin; may cause sensitisation by skin contact)
Australian Occupational Exposure Standards	The chemical has an exposure standard of 0.41 mg/m³, 0.1 ppm; Time Weighted Average (TWA).
International Occupational Exposure Standards	The following exposure standards are identified in Galleria Chemica (2013): · Occupational Exposure limit (TWA) of 0.2 mg/m3 [Canada, China, Denmark, Japan, Korea, UK] · 0.4 mg/m3 TWA [Sweden] · 0.8 mg/m3 TWA [US (NIOSH), Greece]
Australian Food Standards	No Australian food standards relating to the chemical have been identified (Food Standards Australia New Zealand 2013).
Australian Drinking Water Guidelines	No aesthetic or health-related guidance values were identified for this chemical in the Australian Drinking Water Guidelines. (National Health and Medical Research Council (NHMRC) 2011).
Aquatic Toxicity Guidelines	No data available.
PBT Assessment	
P/vP Criteria fulfilled?	No. Readily biodegradable and as such not persistent in the environment.
B/vB criteria fulfilled?	No. As the Log Pow is -0.01 (Log Pow < 4.5), it is not expected to be bioaccumulative.
T criteria fulfilled?	No. Chronic toxicity data >1 mg/L in invertebrates, thus glutaraldehyde does not meet the screening criteria for toxicity.
Overall conclusion	Not PBT

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Toxicity Summary - Benzalkonium Chloride

Chemical and Physical Properties[1,2,3,4]	
CAS number	8001-54-5
Molecular formula	$C_{21}H_{38}ClN$
Molecular weight	340 g/mol
Solubility in water	782 mg/L (C_{12}) (exp.) 16.6 mg/L (C_{16}) (exp.) 3.6 mg/L (C_{18}) (exp.)
Density	0.9429 g/cm^2 at 25°C
Melting point	241°C (exp.)
Boiling point	No data available.
Vapour pressure	3.53 x 10^{-12} mm Hg
Henrys law constant	No data available.
Explosive potential	No data available.
Flammability potential	No data available.
Colour/Form	Clear yellow to straw coloured liquid with an amine odour
Overview	Benzalkonium chloride (BZK, BKC, BAK, BAC), is also known as alkyldimethylbenzylammonium chloride (ADBAC) and by the trade name Zephiran, Benzalkonium chloride is the organic chloride salt of benzododecinium. It has antiseptic and disinfectant properties, and used as a preservative in eye drop formulations. It has a role as an antiseptic drug, a disinfectant, an antifouling biocide and a surfactant. It is a quaternary ammonium salt and an organic chloride salt.
Environmental Fate [1,3]	
Soil/Water/Air	The quaternary ammonium cations from substances in this group partition between water and sediment, or remain in soil when released from industrial uses. If discharged into natural waters, the chemicals are expected to dissociate and release their quaternary ammonium cations and chloride anions. The quaternary ammonium cations can adsorb to clays and natural organic materials, such as humic substances (de Oude, 1992). Adsorption coefficient values reported for the cationic surfactants in this group indicate strong adsorption and immobility in soil (Boethling and Mackay, 2000; LMC, 2013; US EPA, 2006b; Zhang, et al., 2015). The strong binding of benzalkyl quaternary ammonium surfactants to soil is attributable to the strong electrostatic attraction of cationic surfactants to soil (Boethling, 1984). The quaternary ammonium cations of substances in this group are biodegradable. The quaternary ammonium cations from substances in this group have low bioaccumulation potential in aquatic organisms. The chemicals in this group are not expected to undergo long-range transport based on their low volatility, strong binding to soil and their rapid biodegradability in the environment.
Human Health Toxicity Summary[1]	
Chronic Repeated Dose Toxicity	Although the appropriate data are limited, the chemicals in this group are not considered to cause serious damage to health from repeated oral exposure at doses below acutely toxic doses. Lesions have been noted in these studies, possibly due to the corrosive nature of these chemicals having direct effects to the gastrointestinal tract (US EPA, 2008; SCCS, 2009; Consumer Specialty Products Association 2011; REACHa–b). Several repeated dose oral toxicity studies have been conducted on chemicals in this group. As stated above, observed effects were mainly due to the direct irritant effects of these chemicals to the gastrointestinal tract and included decreased body weight and weight gain; increased adrenal and liver weights; increased

	histiocytic hyperplasia in the mesenteric lymph nodes; and lesions in the gastrointestinal tract. In a repeated dose oral toxicity study, cetrimonium bromide (CAS No. 57-09-0) was administered orally to Sprague Dawley (SD) rats (10/sex/dose) at 10, 20, and 45 mg/kg bw/day for one year. While significantly reduced mean body weights and reduced skeletal growth (judged by the growth of the tail) were observed in both sexes at the highest tested dose, significantly decreased efficiency of food conversion was noted only in males at the highest tested dose. Relative caecum weight was increased in males at 20 mg/kg bw/day and in both sexes at 45 mg/kg bw/day. No macroscopic or microscopic alterations were found in the stomach wall and small intestine of treated rats. It was suggested that continued administration of the chemical in large doses could have prevented proper nutrition by increasing the rate of gastric emptying and intestinal transit and/or by interfering with the absorption of nutritional substances. A no observed adverse effect level (NOAEL) of 10 mg/kg bw/day was determined (SCCS, 2009; REACHa). In another repeated dose oral toxicity study, cetrimonium chloride (CAS No. 112-02-7) was administered (gavage) to SD rats at 0, 30, 100, and 300 mg/kg bw/day for 28 days. Inflammatory oedema of the forestomach mucosa, sporadic ulceration, and acanthosis up to papillomatous hyperplasia in both sexes were noted at the highest tested dose of 300 mg/kg bw/day. It was concluded that these changes can be considered a result of local irritation and therefore are not indicative of systemic toxicity. The NOAEL for systemic effects was determined to be 300 mg/kg bw/day (highest tested dose) (SCCS, 2009; REACHb). In a repeated dose oral toxicity study, didecyl dimethyl ammonium chloride (CAS No. 7173-51-5) was administered to rats (10/sex/dose) in the diet at 0, 6.2, 18.5, 36.8, 60.7 and 175.4 mg/kg bw/day for males and 0, 7.5, 22.3, 44.4, 74.3 and 225.5 mg/kg bw/day for females for 13 weeks. High-dose animals showed increased mortality; decreased mean body weights, body weight gain, and food consumption; and increased incidence of gross pathological observations and non-neoplastic lesions, including higher incidence of glycogen depletion in the liver and contracted spleens. Sinus erythrocytosis and lymphoid hyperplasia of mesenteric lymph nodes were also noted in high-dose females. The NOAEL was established as 60.7 mg/kg bw/day and 74.3 mg/kg bw/day in males and females, respectively, based on increased mortality and effects on body weights, liver and spleen at the next highest dose. In another combined chronic toxicity/carcinogenicity study, didecyl dimethyl ammonium chloride (CAS No. 7173-51-5) was administered to SD rats (60/sex/dose) in the diet at approximately 0, 13, 32 or 64 mg/kg bw/day for males and 0, 16, 41 or 83 mg/kg bw/day for females for two years. Treatment-related effects in the high-dose animals included decreased mean body weight, increased incidence of sinusoidal blood, haemosiderosis, and histiocytosis in the mesenteric lymph nodes (US EPA, 2008). In a repeated dose oral toxicity study, didecyl dimethyl ammonium chloride (CAS No. 7173-51-5) was administered to CD-1 mice (60/sex/dose) in the diet at 0, 100, 500 or 1000 ppm (approximately 0, 15.0, 76.3 or 155.5 mg/kg bw day for males and 0, 18.6, 93.1 or 193.1 mg/kg bw/day for females) for 78 weeks. Decreased mean body weights and body weight gains were the only treatment-related effects noted at the highest tested dose. The NOAEL was established as 76.3/93.1 mg/kg bw/day for males/females (US EPA, 2008).
Carcinogenicity	Limited data are available on chemicals in this group and carcinogenicity information was available only on one chemical in this group. The chemicals in this group are also considered not to have mutagenic or genotoxic potential. Therefore, it is considered unlikely that the chemicals in this group will have carcinogenic potential.
Mutagenicity/ Genotoxicity	Although the appropriate data are limited for chemicals in this group, the available information indicate that the chemicals in this group are not considered to have mutagenic or genotoxic potential (US EPA, 2008; IPCS, 2009; SCCS, 2009; Consumer Specialty Products Association 2011; REACHa–e).
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	Although the appropriate data are limited, chemicals in this group are not considered to have specific reproductive or developmental toxicity. Any reproductive and developmental effects were only observed secondary to maternal toxicity. This is also supported by the findings that quaternary ammonium compounds are poorly absorbed through oral exposure. In a developmental toxicity study, dodecyltrimethylammonium chloride (CAS No. 112-00-5) was administered (gavage) to pregnant New Zealand White rabbits (13/dose) at 0, 2, 8 and 24 mg/kg bw/day from gestation days (GD) 6–18. As no

	maternal, developmental or foetal treatment-related effects were observed at any tested dose, the NOAEL was determined to be 24 mg/kg bw/day (US EPA, 2008). In another developmental toxicity study, pregnant New Zealand White rabbits (16/dose) were administered didecyl dimethyl ammonium chloride (CAS No. 7173-51-5) by gavage at 0, 1, 3 and 10 mg/kg bw/day from GD 6–18. At the mid and high doses, maternal toxicity was evident as hypoactivity, laboured and/or audible respiration and decreased body weight gain. An increased maternal mortality was noted at 10 mg/kg bw/day. Developmental effects included increased incidences of foetal mortality and reduced foetal body weight per litter at 10 mg/kg bw/day. The NOAEL for maternal toxicity was established as 1 mg/kg bw/day, based on reductions in body weight gain, hypoactivity, laboured/audible respiration, and mortality. The NOAEL for developmental toxicity was established as 3 mg/kg bw/day, based on increased mortality, decreased foetal body weight, and an increased number of dead foetuses. In another developmental toxicity study, didecyl dimethyl ammonium chloride (CAS No. 7173-51-5) was administered to pregnant SD rats (25/dose) by gavage at doses of 0, 1, 10 and 20 mg/kg bw/day on GD 6–15. The NOAEL for maternal toxicity was established as 1 mg/kg bw/day, based on decreased body weight gain, low food efficiency, and audible respiration. The NOAEL for developmental toxicity was established as 10 mg/kg bw/day, based on an increased incidence of skeletal variations at the next higher dose (US EPA, 2008). In a developmental toxicity study, cetrimonium chloride (CAS No. 112-02-7) was dermally applied to mated female New Zealand White rabbits from GD 7–18 at dose levels of 0, 10, 20 and 40 mg/kg bw/day for two hours/day. Following application, the application site was rinsed with water and dried. Apart from skin effects at the application site, no maternal or foetal signs of toxicity were observed during the study. Skin irritation at the application site was noted at all doses with dose-related severity and duration including erythema, oedema, desquamation, atonia, and coriaceousness. The NOAEL for maternal systemic toxicity as well as for developmental toxicity was established as 40 mg/kg bw/day (no effects at the highest tested dose) (SCCS, 2009). In another developmental toxicity study, stearyl trimethyl ammonium chloride (CAS No. 112-03-8) was dermally applied to mated female SD rats from GD 6–15 at dose levels of 4.5, 7.5 and 12.5 mg/kg bw/day. The chemical was applied with a syringe (gently massaged into the shaved area) and left on the skin. Systemic maternal or foetal signs of toxicity were not noted during the study. Skin irritation was noted at the site of application and was considered to be as a result of local irritation and not indicative of systemic toxicity. The NOAEL for maternal systemic toxicity as well as for developmental toxicity was established as 12.5 mg/kg bw/day (no effects at the highest tested dose) (SCCS, 2009).
Acute Toxicity	The chemicals in this group have moderate acute toxicity following oral exposure in animal tests. The reported oral median lethal dose (LD50) in rats was 410 mg/kg bw for cetrimonium bromide (CAS No. 57-09-0), 490–560 mg/kg bw for dodecyltrimethylammonium chloride (CAS No. 112-00-5), 400–600 mg/kg bw for cetrimonium chloride (CAS No. 112-02-7), 536–633 mg/kg bw for stearyl trimethyl ammonium chloride (CAS No. 112-03-8), 238–262 mg/kg bw for dodecyl dimethyl ammonium chloride (CAS No. 7173-51-5), and 280–305 mg/kg bw for benzalkonium chloride (CAS No. 8001-54-5). Observed sub-lethal effects included sluggishness, lacrimation, diarrhoea, ataxia, loss of righting reflex, red stains around the nose and mouth, and brown stains on the periurogenital fur (IPCS, 1999; US EPA 2006, 2008; SCCS, 2009; Consumer Specialty Products Association, 2011; REACHa-e; RTECS). The chemicals in this group are likely to have low to moderate acute dermal toxicity in animal tests. The reported dermal median lethal dose (LD50) in rats was 4300 mg/kg bw for cetrimonium chloride (CAS No. 112-02-7) (undiluted); >2930 mg/kg bw (65 % purity) and >1000 mg/kg bw (undiluted) for didecyl dimethyl ammonium chloride (CAS No. 7173-51-5) (65 % purity); 930 mg/kg bw for benzalkonium chloride (CAS No. 8001-54-5) (82.26 % purity); 1420 mg/kg bw for C8–18-alkydimethylbenzyl ammonium chlorides (CAS No. 63449-41-2) (undiluted); 2300 mg/kg bw for C12–18 alkyl dimethyl benzyl ammonium chloride (CAS No. 68391-01-5) (undiluted); and 2848 mg/kg bw for C12–16 alkyldimethylbenzylammonium chloride (CAS No. 68424-85-1) (undiluted). A value of 528 mg/kg bw (undiluted) has also been reported for cetrimonium chloride (CAS No. 112-02-7) and for stearyl trimethyl ammonium chloride (CAS No. 112-03-8) as a read across from coconut alkyltrimethyl chlorides (CAS No. 61789-18-2). Observed sub-lethal

	effects included somnolence (generally depressed activity), dermatitis, and haemorrhages.
Irritation	Although data are limited, chemicals in this group are considered to be corrosive chemicals. Corrosive chemicals are also considered to cause irreversible effects on the eyes; the available eye irritation data for chemicals in this group support this finding (US EPA, 2008; SCCS, 2009; REACHb).
Sensitisation	Although limited information is available on the skin sensitisation potential of these chemicals, based on the available information, the chemicals in this group are not likely to be skin sensitisers
Health Effects Summary	The critical health effects for risk characterisation include systemic acute effects (acute toxicity from oral and dermal exposure) and concentration-dependent local effects (corrosivity).
Key Study/Critical Effect for Screening Criteria	The lowest NOAEL of 10 mg/kg bw/day from the one year repeated dose oral toxicity study using cetrimonium bromide (CAS No. 57-09-0) have been adopted for this risk assessment. The NOAEL of 10 mg/kg bw/day will be used to derive an oral reference dose and drinking water guidance value. Uncertainty factors: 10 (interspecies variability); 10 (intraspecies variability) Oral RfD = 10/100 = 0.1 mg/kg/dayDerived drinking water guideline value = 0.39 mg/L
Ecological Toxicity[2]	
Aquatic Toxicity	Acute toxicity: Oncorhynchus mykiss (Rainbow trout) 96 h LC50 = 0.064 mg/L Pimephales promelas (Fathead minnow) 96 h LC50 = 0.28 mg/L Daphnia magna (Water flea) 48 h EC50 = 0.037 mg/L Daphnia magna (Water flea) 48 h EC50 = 0.0059 mg/L Chlorella pyrenoidosa (Green algae) 96 h EC50 = 0.67 mg/L Scenedesmus pannonicus (Green algae) 96 h EC50 = 0.085 mg/L Chronic toxicity: Pimephales promelas (Fathead minnow) 34 d NOAEC = 0.032 mg/L Daphnia magna (Water flea) 21 d NOEC = 0.00415 mg/L
Determination of PNEC aquatic	The PNEC for all chemicals in the group is taken to be equal to the PNEC calculated for benzyl-C -alkyldimethylammonium chlorides (CAS RN 68424-85-1). Aquatic invertebrates are the most sensitive taxon to toxic effects of the chemicals in this group, based on the available information. The PNEC for the chemicals in this group was, therefore, calculated to be 0.83 µg/L based on the 21 d NOEC of 0.00415 mg/L for D. magna. The laboratory chronic toxicity value for this aquatic invertebrate species was divided by an assessment factor of 100 to account for both interspecies variation and the relative lack of chronic aquatic toxicity data available for chemicals in this group. The value derived from this procedure was then multiplied by a factor of 20 to account for the 5% bioavailable fraction in environmental waters.
Current Regulatory Controls[1,5]	
Australian Hazard Classification	Acute toxicity (ingestion) - category 4 Acute toxicity (dermal) - category 4 Acute toxicity (inhalation) - category 2 Skin corrosion – category 1B
Australian Occupational Exposure Standards	No specific exposure standards are available for chemicals in this group.
International Occupational Exposure Standards	No specific exposure standards are available for chemicals in this group.
Australian Food Standards	No data available.
Australian Drinking Water Guidelines	No data available.

Aquatic Toxicity Guidelines	No data available.
PBT Assessment[2]	
P/vP Criteria fulfilled?	No. The chemical is expected to be biodegradable.
B/vB criteria fulfilled?	No. The chemical is expected to have low bioaccumulation potential in aquatic organisms.
T criteria fulfilled?	No, based on available acute ecotoxicity values below 1 mg/L and chronic ecotoxicity values below 0.1 mg/L.
Overall conclusion	Not PBT

References

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Toxicity Summary - Nonoxynol-9

Chemical and Physical Properties[1,3,4]	
CAS number	26571-11-9
Molecular formula	C33H60O10
Molecular weight	616.83 g/mol
Solubility in water	Moderate solubility in water
Density	1.06 at 25 °C/4 °C
Melting point	250°C
Boiling point	6°C
Vapour pressure	No data available.
Henrys law constant	No data available.
Explosive potential	No data available.
Flammability potential	No data available.
Colour/Form	Yellow liquid
Overview	This chemical was assessed as part of a group. The chemicals in this group are: • non-ionic ethoxy ether derivatives of nonylphenol (nonylphenol ethoxylates—NPEs) or octylphenol (octylphenol ethoxylates—OPEs); and • anionic derivatives (sulfate, phosphate, carboxylate) of NPEs or OPEs. Whilst the surfactant properties of the chemicals in this group may vary, the systemic toxicity of the chemicals are expected to be due to the break down into nonylphenols (NPs) or octylphenols (OPs). The NPEs (also referred to as nonoxynols) and OPEs (octoxynols) are manufactured by the reaction of NPs or OPs with ethylene oxide (EO). The NPEs belong to a general chemical category of alkylphenol ethoxylates (APE). The general formula of NPEs is C15H24(C2H4O)n; where 'n' is the number of EO units attached to the phenol ring, and can vary from 1–120. The NPEs differ by the length of the EO chain, which also contributes to different physicochemical properties and the degree of toxicity. The NPEs are considered less toxic than NPs (Health Canada, 1999; US EPA, 2010; CIR, 2015). The NPEs are primarily used as surfactants in a wide range of cosmetic and domestic products (~80–85 % of the production volume of APE surfactants, with the other 20 % being octylphenol ethoxylates) (CalEPA, 2010; US EPA, 2010). Regardless of the precise chemical identities of the chemicals in this group, environmental degradation to nonyl- or octylphenols, thereby increasing the pool of these chemicals available for secondary exposure, is the main health effect which applies to all the chemicals in the group.
Environmental Fate[2]	
Soil/Water/Air	This chemical is slightly soluble in water and has low volatility. When released into the environment, long chain NPEs may remain in water due to their high water solubility and low volatility, whereas shorter chain NPEs have lower water solubility and can adsorb to solids such as sediments and sludge. NPEs are susceptible to substantial biodegradation in the environment. Under aerobic conditions, rapid biodegradation forms nonylphenol ethoxyacetates, and under anaerobic conditions, NPs and shorter-chain NPE degradants are formed. While some degradants are much more persistent relative to their parent chemicals, they are expected to be ultimately biodegradable in the environment. The chemical is not expected to undergo long-range transport based on biodegradability, low volatility, and adsorption to soil and sediment. Although soluble in water, NPEs have a relatively short primary half-life in water.

Human Health Toxicity Summary[1]	
Chronic Repeated Dose Toxicity	Based on the available data from repeated dose oral toxicity studies undertaken in rats, mice and beagle dogs these chemicals are not considered to cause serious damage to health following repeated oral exposure. No data are available for NPEs from repeated dermal or inhalation exposure.
Carcinogenicity	Based on the available data from carcinogenicity studies in rats and mice exposed to NPEs orally and intravaginally, NPEs are not considered to be carcinogenic.
Mutagenicity/ Genotoxicity	Based on the available *in vitro* genotoxicity data, NPEs are not considered to be genotoxic, with negative results obtained for NPEs in several *in vitro* assays. No *in vivo* genotoxicity data are available for NPEs.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	Studies are available only for NPE-9, NPE-10, NPE-30. No data are available for other NPEs. 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.
Acute Toxicity	The acute oral toxicity of NPEs and OPEs could range from low to moderate. The toxicity of NPEs and OPEs is considered to increase with decreasing EO units (or chain length) (Health Canada, 2002). Based on the available data (the median lethal dose (LD50) = 1300 or 1310 mg/kg bw in rats for some NPEs, and 691–1600 in rats for some OPEs.
Irritation	This chemical can cause skin irritation and serious eye irritation. Moderate to severe skin and eye irritation has been reported in animal studies using rabbits and rats. Slight to mild skin irritation has been observed in humans.
Sensitisation	Based on the available data, NPEs are generally not considered to have skin sensitisation potential, however, there is evidence of mild contact dermatitis in human patch tests with short-chain NPEs.
Health Effects Summary	The critical health effects for risk characterisation are skin and eye irritation. NPEs could also cause systemic acute effects from oral exposure. However, these health effects are applicable mainly for short chain length NPEs and the effects could reduce with increasing chain lengths. Those with ≥30 EO chains are reported to be generally non-toxic. While nonoxynol-9 is toxic to reproduction and this is expected to also apply to related NPEs, the effects appear to be specific to direct spermicidal use, which is not relevant to industrial uses of the chemicals. The NPEs biodegrade to NPs in the environment and some products containing NPEs can also contain residual amounts of NPs. Therefore, critical health effects of NPs could also be applicable for risk characterisation under those situations, particularly following secondary exposure from environmental sources.
Key Study/Critical Effect for Screening Criteria	Based on the NHMRC (2008) Australian Guidelines for Water Recycling, Augmentation of Drinking Water Supplies, a guideline value of 500 µg/L has been derived for nonylphenols, using a NOEL of 15 mg/kg bw/day and an uncertainty factor of 100.
Ecological Toxicity[2]	
Aquatic Toxicity	Read across from CAS 9016-45-9 (Polyoxyethylene Nonylphenol Ether) <u>Acute:</u> Fish: 96 h EC50 = 1.3 mg/L (Lepomis macrochirus) Invertebrates: 48 h EC50 = 0.328 mg/L (read across from nonylphenol monoethoxylate, CAS RN 27986-36-3) Algae: 5 d EC50 = 37.4 mg/L (Scenedesmus opoliensis), <u>Chronic:</u> Fish: 21 d NOEC = 0.048 mg/L (Oncorhynchus mykiss) (read across from nonylphenol monoethoxylate, CAS RN 27986-36-3)

	Invertebrates: 6 d NOEC = 1.0 mg/L (Daphnia magna) Algae: 96 h NOEC = 8.0 mg/L (Pseudokirchneriella subcapitata)
Determination of PNEC aquatic	Fish are the most sensitive taxon to toxic effects of the chemicals in this group, based on the available information. The $PNEC_{aqua}$ derived for the most toxic chemical in this group, nonylphenol monoethoxylate, is 0.48 µg/L based on the 21 d NOEC of 0.048 mg/L for Oncorhynchus mykiss. The laboratory chronic toxicity value for this fish species was divided by an assessment factor of 100 to account for both interspecies variation and the relative lack of chronic aquatic toxicity data available for chemicals in this group.
Current Regulatory Controls[1,4,5]	
Australian Hazard Classification	Acute toxicity (ingestion) - category 4 Eye irritation – category 2A Skin irritation – category 2
Australian Occupational Exposure Standards	No specific exposure standards are available.
International Occupational Exposure Standards	No specific exposure standards are available.
Australian Food Standards	No data available.
Australian Drinking Water Guidelines	No aesthetic or health-related guidance values were identified for CAS 26571-11-9 in the National Health and Medical Research Council (NHMRC) Australian Drinking Water Guidelines (NHMRC, 2022). However, a guideline value of 500 µg/L has been derived for drinking water augmentation for nonylphenols.
Aquatic Toxicity Guidelines	No data available.
PBT Assessment[2]	
P/vP Criteria fulfilled?	No. The chemical is expected to undergo degradation in the environment.
B/vB criteria fulfilled?	No. The chemical is expected to have low to moderate bioaccumulation potential in aquatic organisms.
T criteria fulfilled?	No. Based on available acute ecotoxicity values above 1 mg/L and chronic ecotoxicity values above 0.1 mg/L, this chemical is categorised as Not Toxic.
Overall conclusion	Not PBT

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Toxicity Summary - [redacted]

Chemical and Physical Properties[1,2,3]	
CAS number	[redacted]
Molecular formula	C9H28N3O15P5.xNa
Molecular weight	595.18 g/mol
Solubility in water	50% w/w
Density	No data available.
Melting point	Expected to melt at a higher temperature than the acid, and to decompose
Boiling point	Expected to melt at a higher temperature than the acid, and to decompose
Vapour pressure	<1.67 x 10-10 Pa (estimated)
Henrys law constant	No data available.
Explosive potential	No data available.
Flammability potential	No data available.
Colour/Form	Organic, solid
Overview	This chemical has been assessed as part of a group which covers a phosphonic acid and sodium salts of that acid. This group consists of [redacted] A Tier 1 Human Health assessment for this chemical has been conducted by NICNAS which concluded that it was low concern to human health and the environment and thus required no further assessment.
Environmental Fate [1,3]	
Soil/Water/Air	The properties of [redacted] and its salts are profoundly directed by their ionisation behaviour. [redacted] can ionise by loss of a hydrogen ion up to six times. As a consequence it is a strong complexing agent, and is highly hydrophilic. Because ionisation is a rapid and reversible process, salts such as sodium and potassium salts will dissolve readily in water to give a speciation state dictated by the pH of the medium. [redacted] and its salts may enter the environment via normal use in water treatment applications. It is predicted and has been shown to be adsorbed by inorganic matrices, and therefore adsorption to sewage sludge and soil is strong (measured Koc = 9748 L/kg). They are not readily biodegradable in laboratory studies carried out under standard conditions. Although these data suggest the potential for persistence, there is, however, evidence of partial degradation by abiotic processes in natural waters, and biodegradation following acclimation, or under conditions of low inorganic phosphate. In the presence of commonly found metal ions possessing redox properties, such as iron, metal-catalysed photodegradation can be rapid, which promotes further biodegradation. [redacted] is not expected to be bioaccumulative, based on its low Log Kow and read-across from the two related substances ATMP and HEDP.
Human Health Toxicity Summary[1,2]	
Chronic Repeated Dose Toxicity	The salt of [redacted] has been studied in a good quality 90 day feeding study conforming to OECD guidelines. Repeated exposure to 842 mg/kg bw/d (males) and 903 mg/kg bw/d (females) resulted in perturbations of iron and calcium homeostasis (in the absence of any concurrent alteration of calcium plasma levels). Changes in some blood parameters and an increase in total bone density were seen at this dose. The NOAEL for this study was therefore 83 mg/kg bw/day based on the mid dose male group.

	There are a number of further studies available on the salt, covering durations from 90 days, one year or two years. In addition to effects on iron homeostasis and haematological effects, two of these studies have reported effects on liver pathology and NOAELs down to 4 mg/kg bw/d have been assigned. As these are secondary literature, where there is insufficient information for full evaluation, the findings are not considered to outweigh the recent GLP and OECD compliant 90-day study.
Carcinogenicity	A chronic toxicity/carcinogenicity study on CAS [redacted] (as a neutralized solution of 50% of the sodium salt in water) was conducted (Procter and Gamble, 1987, quoted in ECB IUCLID 2000). 50 male and 50 female rats were fed doses equivalent to 4, 20 and 100mg/kg bw/d. 171 animals were stated to have died during the study, with no particular necropsy or histopathology findings. The distribution of mortality across the groups was not stated, but the mortality was not considered to be related to treatment. In this study there were no biologically significant differences in neoplastic findings between the control and treated groups (Procter and Gamble, 1987, secondary literature). Miscellaneous observations, which are probably related to altered mineral metabolism as a result of the chelation properties of the substance, were reported. As the study report is not available for review, the reliability of this study cannot be assessed. The high mortality rate may have compromised the power of the study to detect effects.
Mutagenicity/ Genotoxicity	[redacted] and its salt are not considered to pose a genotoxic hazard.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	The reproductive NOAEL for [redacted] in the rat is 294 mg/kg bw/day for parental males and 312 mg/kg bw/day for parental females. No histopathological changes were apparent in reproductive tissue from male or female rats following gavage administration of 850-900 mg/kg bw /day of the sodium [redacted] for up to 90 days. Results from a rat reproduction study provided evidence of equivocal fetotoxicity with a NOAEL of 100 mg/kg bw/day and a NOAEL of 312 mg/kg bw/day for teratogenicity of [redacted] in the rat, however these observations were not replicated in a developmental toxicity study on sodium [redacted] which provided a NOAEL of 1000 mg/kg bw/day for fetotoxicity and 2000 mg/kg bw/day for teratogenicity.
Acute Toxicity	The [redacted] acid and salts are of low oral and dermal toxicity. The oral rat LD50 is 4164 mg/kg bw and the rabbit LD50 is higher (>4605 mg/kg bw). The acute rat oral LD50 of the heptasodium salt lies between 5838 and 8757 mg/kg bw. The dermal LD50 values for the salts are >5838 mg/kg bw for the rat. For the octasodium salt, the oral LD50 is >3870 mg/kg bw and the dermal LD50 >860mg/kg bw for the rabbit.
Irritation	Several studies on [redacted] acid and its salts indicate they have a low skin irritation potential. There is evidence that [redacted] acid is an eye irritant, although different severities were reported in the two available assays (mild and severe).
Sensitisation	Not expected to have sensitization potential.
Health Effects Summary	The chemicals in this category possess properties indicating a hazard for human health (eye irritation, potential perturbations of iron and calcium homeostasis). These hazards do not warrant further work as they are related to pH effects and chelation properties. This chemical has been identified by NICNAS to be of low concern to human health.
Key Study/Critical Effect for Screening Criteria	The lowest NOAEL of 83 mg/kg bw/day from the 90-day feeding study on the salt of [redacted] have been adopted for this risk assessment. The NOAEL of 83 mg/kg bw/day will be used to derive an oral reference dose and drinking water guidance value. Uncertainty factors: 10 (interspecies variability); 10 (intraspecies variability) Oral RfD = 83/100 = 0.83 mg/kg/dayDerived drinking water guideline value = 3.24 mg/L
Ecological Toxicity[2]	
Aquatic Toxicity	[redacted] and its salts are of low acute toxicity to fish and aquatic invertebrates. The lowest reliable acute toxic concentrations determined for [redacted] are a 96-h LC50 for the rainbow trout, Oncorhynchus mykiss, that is in the range 180-252 mg/l and EC50 values determined in acute tests with aquatic invertebrates are all in excess of 150 mg/l. [redacted] is of low chronic toxicity to fish (O. mykiss 60-day NOEC: 25.6 mg/l). There are no chronic data for aquatic invertebrates but an acute sub-lethal

	test with the oyster, Crassostrea virginica, yielded a 96-hour EC50 for effects on shell growth of 155.8 mg/l and a NOEC of 55.5 mg/l. The 2Na and 7Na salts of [redacted] are of low acute toxicity to the marine sediment living amphipod Corophium volutator (10-day LC50: >2500 mg/kg dw)
Determination of PNEC aquatic	Aquatic toxicity data are available from short-term tests conducted with species representative of three trophic levels: fish, invertebrates and algae. Data are also available on chronic/prolonged toxicity to fish (60-day NOEC = 25.6 mg/l) and algae (14-day NOEC = 5.2 mg/l). On the basis that the data consists of short and long-term results from three trophic levels, an assessment factor of 10 has been applied to the lowest chronic endpoint of 25.6 mg/L for Daphnia magna. The PNECaquatic is 2.56 mg/L.
Current Regulatory Controls[4,5]	
Australian Hazard Classification	No data available.
Australian Occupational Exposure Standards	No data available.
International Occupational Exposure Standards	No data available.
Australian Food Standards	No data available.
Australian Drinking Water Guidelines	No data available.
Aquatic Toxicity Guidelines	No data available.
PBT Assessment[2]	
P/vP Criteria fulfilled?	Potentially. Not rapidly degradable.
B/vB criteria fulfilled?	No. Based on the low log Kow (-3.40) and read-across from related substances, [redacted] and its salts are not expected to bioaccumulate.
T criteria fulfilled?	No. The NOECs from the chronic aquatic toxicity data are >0.01 mg/L, hence does not meet the screening criteria for toxicity.
Overall conclusion	Not PBT

References

1. Australian Industrial Chemicals Introduction Scheme (AICIS) online database. IMAP, Tier I Assessment for [redacted]
2. OECD (2004) SIDS Initial Assessment Report for 18th SIAM on [redacted]
3. PubChem Compound Summary. National Center for Biotechnology Information. (PubChem). Retrieved 2024: [redacted]
4. HCIS, Hazardous Chemical Information System, Safe Work Australia, Retrieved 2024: http://hcis.safeworkaustralia.gov.au/HazardousChemical.
5. ILO, International Labour Organisation, International Chemical Safety Cards (ICSCs), Retrieved 2024: [redacted]

Toxicity Summary - Sodium hydroxide

Chemical and Physical Properties[1,2,3,4,5]	
CAS number	1310-73-2
Molecular formula	Na-OH
Molecular weight	40
Solubility in water	520 g/L at 25°C
Melting point	318°C
Boiling point	1388°C
Vapour pressure	Negligible at 25°C
Henrys law constant	No data found.
Explosive potential	No
Flammability potential	No
Colour/Form	Colourless to white deliquescent odourless solid.
Overview	At room temperature, sodium hydroxide is a white crystalline odourless solid that absorbs moisture from the air. It is a manufactured substance. When dissolved in water or neutralized with acid it liberates substantial heat, which may be sufficient to ignite combustible materials. Sodium hydroxide is very corrosive. It is generally used as a solid or a 50% solution. Other common names include caustic soda and lye. Sodium hydroxide is used to manufacture soaps, rayon, paper, explosives, dyestuffs, and petroleum products. It is also used in processing cotton fabric, laundering and bleaching, metal cleaning and processing, oxide coating, electroplating, and electrolytic extracting. It is commonly present in commercial drain and oven cleaners. A Tier 1 Environmental Assessment for this chemical has been conducted by NICNAS which concluded that it was low concern to the environment.
Environmental Fate[2]	
Soil/Water/Air	The high water solubility and low vapour pressure indicate that NaOH will be found predominantly in the aquatic environment. NaOH is present in the environment as sodium and hydroxyl ions, which implies that it will not adsorb on particulate matter or surfaces and will not accumulate in living tissues. Both sodium and hydroxyl ion have a wide natural occurrence. Atmospheric emissions of NaOH are rapidly neutralized by carbon dioxide or other acids and the salts (e.g. sodium carbonate) will be washed out by rain (Cooper et al., 1979). For this reason, potential atmospheric emissions of NaOH are considered of no concern. Significant emissions to the terrestrial environment are not expected during normal handling and use of NaOH. Small terrestrial emissions will be neutralized by the buffer capacity of the soil. For this reason, the environmental assessment can be limited to the aquatic compartment.
Human Health Toxicity Summary[1,2,3,4,5]	
Chronic Repeated Dose Toxicity	No animal data are available on repeated dose toxicity studies by oral or dermal routes for sodium hydroxide. In a repeat dose inhalation study, twenty-seven white rats died within a month, mostly from bronchopneumonia, after being exposed twice weekly to an aerosol of unknown airborne concentration of sodium hydroxide, generated from an aqueous 40% sodium hydroxide solution (NIOSH 1975). When exposed to an aerosol generated from a 20% sodium hydroxide solution, the bronchi were dilated, the epithelial cover was thin and frequently desquamated, and the septa were dilated and cracked. A light round cell infiltration of the sub-mucus membrane tissue was also observed. Few changes occurred in a group of rats exposed to aerosols from 10% sodium hydroxide, but rats exposed to an aerosol of 5% sodium hydroxide had dilation of the bronchi and a slight degeneration of the mucus membrane and thickened strata of lymphadenoid tissue surrounding the bronchi. A NOAEL could not be established in this study.

	Workers exposed to 0.24 to 1.86 mg/m^3 sodium hydroxide for 2 to 15 minutes reported throat irritation and watery eyes (NIOSH 1975). Based on the observations of the irritant effects on workers exposed to 1 to 40 mg/m^3 sodium hydroxide, it was concluded that 2 mg/m^3 represented a concentration that is 'noticeably but not extensively irritant' (NIOSH 1975). Obstructive airway disease has been reported following chronic occupational exposure to sodium hydroxide mist (IPCS 1996). The patient developed cough, dyspnoea and tachypnoea after a 20-year exposure to sodium hydroxide.
Carcinogenicity	IARC Category 3 - not classifiable as to human carcinogenicity
Mutagenicity/ Genotoxicity	Sodium hydroxide was assayed in the Ames reversion test with S. typhimurium strains TA1535, TA1537, TA1538, TA98, TA100 and in a DNA-repair test with E. coli strains WP2, WP67 and CM871 (De Flora et al. 1984). Based on the results of these tests, sodium hydroxide was considered to be non-genotoxic. A mouse bone marrow micronucleus test using 15 mM sodium hydroxide at a dose of 10 mg/kg bw revealed no significant increase of nuclei (Morita et al. 1989). The test compound was administered as a single intraperitoneal dose to five males and five females at 30, 48 and 72h (Aaron et al. 1989). The clastogenic activity of sodium hydroxide was studied in an in vitro chromosomal aberration test using Chinese hamster ovary (CHO) K1 cells. No clastogenic activity was found at concentrations of 0, 4, 8 and 16 mM sodium hydroxide, which corresponded with initial pH values of 7.4, 9.1, 9.7 and 10.6, respectively. Based on the results of these tests sodium hydroxide was considered non genotoxic (OECD 2002).
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	The effect of sodium hydroxide on fertility is not known. No valid studies were identified regarding effects on fertility or developmental toxicity in animals after oral, dermal or inhalation exposure to sodium hydroxide. Sodium hydroxide is not expected to be systemically available in the body under normal handling and use conditions and for this reason it can be stated that the substance will not reach the foetus nor reach male and female reproductive organs (ECB 2008).
Acute Toxicity	No acute oral studies using international guidelines are available in animals to establish a median lethal dose (LD50) for sodium hydroxide. In a very old acute oral study in rabbits using 1 to 10% sodium hydroxide, an LD50 of 325 mg/kg bw was established (Naunyn-Schiedeberg 1937). Mortality was also observed when 1% sodium hydroxide was dosed but in this case the administered volume was relatively high (24 mL/kg bw). An oral LD50 of 140 to 340 mg/kg in rats has also been reported (National Research Council 2011), however details of the study are not available. In an acute dermal study, mice were treated dermally with 50% sodium hydroxide, and the treated area was irrigated with water at various intervals (OECD 2002). The mortality of mice was 20, 40, 80 and 71% when they were irrigated at 30 minutes, one hour, two hours or not at all after the application. All animals developed rapidly progressive burns. No mortality or burns were observed when the treated area was irrigated immediately after the application. A 5% aqueous solution of sodium hydroxide produced severe necrosis when applied to the skin of rabbits for four hours (Clayton and Clayton 1993). A dermal LD50 of 1350 mg/kg has been reported in rabbits (National Research Council 2011), however details of the study are not available. A median lethal concentration (LC50) for sodium hydroxide is not available. In an acute inhalation study, 10 Wistar rats were exposed to an aerosol of 40% aqueous sodium hydroxide with particle size less than 1 µm in diameter (Clayton and Clayton 1993). After three weeks, two of the 10 rats died. Examination showed mostly normal lung tissue with foci of enlarged alveolar septa, emphysema, bronchial ulceration, and enlarged lymph adenoidal tissues.
Irritation	Sodium hydroxide is a corrosive irritant to skin, eyes and mucous membranes. A NaOH solution of 8% can be considered corrosive based on animal data. Human data indicate that concentrations of 0.5 to 4% were irritating.
Sensitisation	Skin sensitisation data were reported by Park and Eun (1995). The backs of male volunteers were exposed to sodium hydroxide concentrations of 0.063 to 1.0% (induction). After seven days the volunteers were challenged to a concentration of 0.125%. The irritant response correlated well with the concentration of sodium hydroxide, but an increased response was not observed when the previously patch

<table>
<tr><td></td><td>tested sites were re-challenged. Based on this study, sodium hydroxide has no skin sensitisation potential and is not considered to be a skin sensitiser.</td></tr>
<tr><td>Health Effects Summary</td><td>An oral LD50 of 325 mg/kg in rats and a dermal LD50 of 1350 mg/kg in rabbits were reported for sodium hydroxide. Lethality has been reported in animals at oral doses of 240 mg/kg bw. Inhalational LC50 is not available.
Sodium hydroxide is corrosive to skin, eyes and gastrointestinal and respiratory tracts. Based on human data, concentrations of 0.5 to 4.0% are irritating to the skin, while a concentration of 8.0% is corrosive. Sodium hydroxide is not a skin sensitiser.
No animal data were available on repeated dose toxicity by oral or dermal routes for sodium hydroxide. In the single reported repeat dose inhalation study, a NOAEL could not be established.
Both in vitro and in vivo genetic toxicity tests indicated no evidence of a mutagenic activity. Information is not available on reproductive and developmental toxicity and carcinogenicity of sodium hydroxide.
Due to dissociation into ions which are subject to homeostatic controls in the human body, systemic effects from repeated exposures to sodium hydroxide are not expected. The critical health effect of sodium hydroxide is its corrosive effect.</td></tr>
<tr><td>Key Study/Critical Effect for Screening Criteria</td><td>No oral TRV apply. Sodium hydroxide is corrosive to the skin, eyes and gastrointestinal and respiratory tracts. Based on human data, concentrations of 0.5–4.0 % are irritating to the skin, while a concentration of 8.0 % is corrosive.
The Australian drinking water guideline value for pH may apply to sodium hydroxide.</td></tr>
<tr><td colspan="2">Ecological Toxicity[4]</td></tr>
<tr><td>Aquatic Toxicity</td><td>Measured acute endpoints were available for fish (196 mg/L).
Measured chronic endpoint were available for Daphnia (240 mg/L)</td></tr>
<tr><td>Determination of PNEC aquatic</td><td>A Tier 1 Environmental Assessment for this chemical has been conducted by NICNAS which concluded that it was low concern to the environment.</td></tr>
<tr><td colspan="2">Current Regulatory Controls[4]</td></tr>
<tr><td>Listed as a Chemical of Concern on International Databases</td><td>
<table>
<tr><th>International Database</th><th>Listed?</th></tr>
<tr><td>European REACH regulation Substances of very high concern (SVHCs) according to Annex XV
https://echa.europa.eu/candidate-list-table</td><td>No</td></tr>
<tr><td>International Agency for Research on Cancer (IARC) as a Group 1, 2A or 2B carcinogen
https://monographs.iarc.who.int/list-of-classifications</td><td>No</td></tr>
<tr><td>National Toxicology Program (NTP) Report on Carcinogens (RoC)
https://ntp.niehs.nih.gov/whatwestudy/assessments/cancer/roc/index.html</td><td>No</td></tr>
<tr><td>US EPA Integrated Risk Information System (IRIS) as carcinogenic to humans, or likely / probable / possibly carcinogenic to humans
EU list chemicals with endocrine disruption listed in Category 1 or Category 2
https://www.epa.gov/iris</td><td>No</td></tr>
<tr><td>United States Endocrine Disrupter Screening Program
https://www.epa.gov/endocrine-disruption/endocrine-disruptor-screening-program-tier-1-screening-determinations-and</td><td>No</td></tr>
<tr><td>Agency for Toxic Substances and Disease Registry (ATSDR) as a neurotoxin
https://wwwn.cdc.gov/TSP/index.aspx?sysid=18</td><td>No</td></tr>
<tr><td>Montreal Protocol
https://www.dcceew.gov.au/environment/protection/ozone/montreal-protocol</td><td>No</td></tr>
<tr><td>Rotterdam Convention
http://www.pic.int/TheConvention/Chemicals/AnnexIIIChemicals</td><td>No</td></tr>
<tr><td>Stockholm Convention
http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx</td><td>No</td></tr>
</table>
</td></tr>
<tr><td>Australian Hazard Classification</td><td>Sodium hydroxide is classified as hazardous for human health in the Hazardous Substances Information System (HSIS) with the following risk phrase (Safe Work Australia 2013):
• C: R35 (Corrosive, causes severe burns)</td></tr>
</table>

	Mixtures containing the chemical are classified as hazardous with the following risk phrases based on the concentration (Conc) of the chemical in the mixtures. The risk phrases for this chemical are: • Conc ≥5%: C; R35 (Corrosive, causes severe burns) • 2% ≤Conc <5%: C; R34 (Corrosive, causes burns) 0.5% ≤Conc <2%: Xi; R36/38 (Irritant, irritating to eyes and skin).
Australian Occupational Exposure Standards	Sodium hydroxide has an exposure standard of 2 mg/m^3, Time Weighted Average (Safe Work Australia 2013).
International Occupational Exposure Standards	Occupational Exposure Limit (OEL) or limit values in working environment of 2 mg/m^3 [Argentina, Belgium, Bulgaria, Canada, China, India, Japan and the US (NIOSH 1975)]. Occupational exposure standard: 2 mg/m^3 [Korea] Occupational exposure limit values: 0.5 mg/m^3 [Latvia] Short Term Exposure Limit (STEL): 2 mg/m^3 [UK] US Department of Energy Temporary Emergency Exposure Limits (TEELs) = 0.5 mg/m^3 (TEEL-0 and TEEL-1), 5 mg/m^3 (TEEL-2) and 50 mg/m^3 (TEEL-3).
Australian Food Standards	The Australia New Zealand Food Standards code for sodium hydroxide has the following inclusion: Processing aids - Generally permitted - permitted for use as acidity regulator (FSANZ 2013). Sodium hydroxide is allotted an International Numbering System (INS) of food additives number: INS 524 (Food Standards Australia New Zealand 2013).
Australian Drinking Water Guidelines	No aesthetic or health-related guidance values were identified for sodium hydroxide. However, since sodium hydroxide readily dissociates in water into sodium and hydroxyl ions, the Australian Drinking Water Guidelines for sodium state that, based on aesthetic considerations (taste), the concentration of sodium in drinking water should not exceed 180 mg/L (National Health and Medical Research Council (NHMRC) 2011). No health-based guideline value is proposed for sodium. Medical practitioners treating people with severe hypertension or congestive heart failure are advised to be aware of the sodium concentration in the patient's drinking water exceeding 20 mg/L (NHMRC 2011).
Aquatic Toxicity Guidelines	No data found.
PBT Assessment	
P/vP Criteria fulfilled?	Not applicable (inorganic salt, ionic species ubiquitous in environment).
B/vB criteria fulfilled?	Not applicable. Bioaccumulation is not applicable to these inorganic ions; sodium and hydroxide ions are ubiquitous and are present in most water, soil and sediment.
T criteria fulfilled?	Not applicable. Chronic toxicity data >0.01 mg/L in invertebrates, thus sodium hydroxide does not meet the screening criteria for toxicity.
Overall conclusion	Not PBT

References

1. Australian Industrial Chemicals Introduction Scheme (AICIS) online database. IMAP, Human Health Tier II Assessment for Sodium hydroxide: Retrieved 2024: https://www.industrialchemicals.gov.au/.
2. OECD (2002) SIDS Initial Assessment Report for SIAM 14 on Sodium Hydroxide, UNEP Publications. Retrieved 2024: https://hpvchemicals.oecd.org/ui/handler.axd?id=4d5cda68-5a7d-4ab6-85ec-20a0fd6592ca.
3. PubChem Compound Summary. National Center for Biotechnology Information. (PubChem). Retrieved 2024: https://pubchem.ncbi.nlm.nih.gov/compound/Sodium-Hydroxide.
4. Department of the Environment and Energy 2017, National assessment of chemicals associated with coal seam gas extraction in Australia, prepared by the National Industrial Chemicals Notification and Assessment Scheme.
5. Aschberger K, Cosgrove O, De Coen W, Lund B, Pakalin S, Paya Perez A, Vegro S, editors. European Union Summary Risk Assessment Report - Sodium Hydroxide. EUR 23040 EN/2. Luxembourg (Luxembourg): OPOCE; 2008. JRC41941

Toxicity Summary - Sodium carbonate

Chemical and Physical Properties[1,2,3,4,6]	
CAS number	497-19-8
Molecular formula	Na_2CO_3
Molecular weight	105.99 g/mol
Solubility in water	215 g/l at 20 °C
Melting point	851 °C
Boiling point	Decomposition
Vapour pressure	No data found
Henrys law constant	No data found
Explosive potential	It reacts violently with acids and reacts with magnesium, phosphorous pentoxide causing explosion hazard
Flammability potential	Reacts with fluorine causing fire hazard
Colour/Form	White powder
Overview	Sodium carbonate has been reviewed in the OECD-SIDS program (OECD, 2002a,b).Sodium carbonate is a strong alkaline compound with a pH of 11.6 for a 0.1M aqueous solution. The pKa of carbonate (CO3 2-) is 10.33, which means that at a pH of 10.33 both carbonate and bicarbonate are present in equal amounts. In water, sodium carbonate dissociates into sodium ion (Na+) and carbonate (CO3 2-). The carbonate ions will react with water, resulting in the formation of bicarbonate and hydroxide, until equilibrium is established. Sodium carbonate is used in many countries (e.g. U.S. and EU) as a food additive. It is regarded as a 'Generally Recognised as Safe' (GRAS) substance in food with no limitation other than current good manufacturing practice. Sodium carbon is extensively used across a range of industries and processes such as in the manufacturing of sodium salts, glass, soap/detergents and aluminium. 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. A Tier 1 Environmental Assessment for this chemical has been conducted by NICNAS which concluded that it was low concern to the environment.
Environmental Fate[1,2,3,4]	
Soil/Water/Air	The high water solubility and low vapor pressure indicate that sodium carbonate will be found predominantly in the aquatic environment. In water, sodium carbonate dissociates into sodium (Na+) and carbonate (CO3 2-) and both ions will not adsorb on particulate matter or surfaces and will not accumulate in living tissues.
Human Health Toxicity Summary[1]	
Chronic Repeated Dose Toxicity	No chronic oral and dermal data are available. Due to the biological importance of the products formed by the stomach acid (biocarbonate and carbon dioxide), systemic toxicity is not expected. In rats, histopathological changes of the respiratory tract and the lungs were seen following repeated inhalation exposure to sodium carbonate (70 mg/m^3 aqueous sodium cabonate at pH 11.6 for 3.5 months) and potassium carbonate (0.4 mg/L potassium carbonate at pH 9.9 for 21days). These effects were considered local responses to the high alkalinity of this group of chemicals (OECD, 2002; REACHa; REACHb).
Carcinogenicity	No data are available. Based on the available data from carcinogenicity studies with related substances (sodium bicarbonate and potassium bicarbonate), the chemicals in this group are not considered carcinogenic (OECD, 2002; REACHa; REACHb). Carbonate ions are neutralised under physiological conditions to form

	bicarbonate ions and/or carbon dioxide, which are major products of all human metabolic activities; therefore, systemic toxicity is not expected.
Mutagenicity/ Genotoxicity	Based on the available data, this chemical is not considered to be genotoxic (OECD, 2002; REACHa; REACHb). Carbonate ions are neutralised under physiological conditions to form bicarbonate ions and/or carbon dioxide, which are major products of all human metabolic activities; therefore, systemic toxicity is not expected.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	Based on the limited information available, this chemical does not show specific reproductive or developmental toxicity (OECD, 2002; REACHa; REACHb). Carbonate ions are neutralised under physiological conditions to form bicarbonate ions and/or carbon dioxide, which are major products of all human metabolic activities; therefore, systemic toxicity is not expected.
Acute Toxicity	In animal tests, this chemical was of low acute toxicity following oral exposure. The median lethal dose (LD50) was >2000 mg/kg bw in rats (OECD, 2002; REACHa; REACHb).The majority of the animals that died following acute oral exposure to sodium carbonate at concentrations up to 2600 mg/kg/bw showed oral or nasal discharge, lesions in the liver, mottled lungs, mottled or pale kidneys and a red or partly gas-filled gastro-intestinal tract. In animal tests, this chemical was of low acute toxicity following dermal exposure. The median lethal dose (LD50) was >2000 mg/kg bw in rats (OECD, 2002; REACHa; REACHb). No systemic effects were observed following dermal exposure to sodium carbonate. Local severe skin irritation (severe erythema and oedema) was seen at the application site (OECD, 2002; REACHa; REACHb). In animal tests, this chemical was of low acute toxicity following inhalation exposure. The median lethal dose (LC50) was >2000 mg/m^3 in rats (OECD, 2002; REACH, a & b). Signs of respiratory impairment including dyspnoea, wheezing, excessive salivation and a distended abdomen were observed immediately after inhalation exposure to sodium carbonate of up to 2300 mg/m^3. Excessive salivation, repeated swallowing and a lack of appetite were observed 2–5 hours after exposure. Animals that died had lesions in the anterior trachea, posterior pharynx and larynx, along with an accumulation of mucus, vesiculation and mucosal oedema (REACHa).
Irritation	Sodium carbonate is classified as hazardous with the risk phrase 'Irritating to eyes' (Xi; R36) in HSIS (Safe Work Australia). However, in several eye irritation studies in rabbits, sodium carbonate was found to be severely irritating to the eyes, with effects including conjunctivitis, marked corneal opacity and iritis, which persisted for seven days (REACHa; REACHb). The available data support an amendment to the current HSIS eye irritation classification for sodium carbonate.
Sensitisation	Based on the limited data available, sodium carbonate is not considered to be skin sensitisers (OECD, 2002; REACHa; REACHb). No structural flags for sensitisation are present.
Health Effects Summary	Sodium carbonate has low acute oral, dermal and inhalation toxicity. The acute oral LD50 in rats is 2 800 mg/kg bw, while the dermal LD50 in rats is >2 000 mg/kg bw. The LC50 in guinea pig, mice and rat are 800, 1 200 and 2 300 mg/m^3 respectively. Sodium carbonate has low skin irritation potential. It is a severe eye and respiratory irritant. Information on repeated dose toxicity by the oral and dermal routes is not available. Given that the constituent ions are normal components of the body that are subject to homeostatic controls, systemic effects from repeated doses are not expected. In rats, inhalation exposure to 2% sodium carbonate aerosol (70 mg/mg^3) for over three months did not have any adverse effect. Histopathological changes of the respiratory tract and lungs seen following repeated inhalation exposure were considered local responses to the high alkalinity of this group of chemicals. A No Observed Adverse Effect concentration (NOAEC) of 70 mg/m^3 for sodium carbonate was established in this study for local reversible effects. In the absence of a more suitable NOAEL, this NOAEC will be taken forward for risk assessment. Sodium carbonate was not genotoxic or carcinogenic. Reproductive toxicity studies are not available; however, no effects on reproductive organs were noted

	when rats were exposed to sodium carbonate aerosol. Developmental studies with rats did not show any toxicity.
Key Study/Critical Effect for Screening Criteria	Information on repeated dose toxicity by the oral and dermal routes is not available. Given that the constituent ions are normal components of the body that are subject to homeostatic controls, systemic effects from repeated doses are not expected.
Ecological Toxicity [1,2,3,4]	
Aquatic Toxicity	The acute 96-hour LC50 to three sizes of Bluegill sunfish (*Lepomis macrochirus*) exposed to sodium carbonate is 300 mg/L for all sizes. The acute 96-hour LC50 to mosquitofish (*Gambusia affinis*) is 740 mg/L. The acute 48-hour EC50 value to the invertebrate *Ceriodaphnia* cf. *dubia* is from 200 to 227 mg/L. The chronic endpoint to *Daphnia* is 424 mg/L.
Determination of PNEC aquatic	A Tier 1 Environmental Assessment for this chemical has been conducted by NICNAS which concluded that it was low concern to the environment.
Current Regulatory Controls[1]	

Listed as a Chemical of Concern on International Databases

International Database	Listed?
European REACH regulation Substances of very high concern (SVHCs) according to Annex XV https://echa.europa.eu/candidate-list-table	No
International Agency for Research on Cancer (IARC) as a Group 1, 2A or 2B carcinogen https://monographs.iarc.who.int/list-of-classifications	No
National Toxicology Program (NTP) Report on Carcinogens (RoC) https://ntp.niehs.nih.gov/whatwestudy/assessments/cancer/roc/index.html	No
US EPA Integrated Risk Information System (IRIS) as carcinogenic to humans, or likely / probable / possibly carcinogenic to humans https://www.epa.gov/iris	No
EU list chemicals with endocrine disruption listed in Category 1 or Category 2 https://edlists.org/	No
United States Endocrine Disrupter Screening Program https://www.epa.gov/endocrine-disruption/endocrine-disruptor-screening-program-tier-1-screening-determinations-and	No
Agency for Toxic Substances and Disease Registry (ATSDR) as a neurotoxin https://wwwn.cdc.gov/TSP/index.aspx?sysid=18	No
Montreal Protocol https://www.dcceew.gov.au/environment/protection/ozone/montreal-protocol	No
Rotterdam Convention http://www.pic.int/TheConvention/Chemicals/AnnexIIIChemicals	No
Stockholm Convention http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx	No

Australian Hazard Classification	Sodium carbonate is classified as hazardous, with the following risk phrases for human health in the Hazardous Substances Information System (HSIS) (Safe Work Australia): 'Xi; R36 (Irritating to eyes)'.
Australian Occupational Exposure Standards	Sodium carbonate has an exposure standard of 7.5 mg/m^3 (5 ppm) time weighted average (TWA) and 15 mg/m^3 (10 ppm) short-term exposure limit (STEL) (Safework Australia).
International Occupational Exposure Standards	Occupational exposure standard limits for sodium and potassium carbonate recommended by other countries are provided below (Galleria Chemica, 2013): US Dept of Energy (DOE) Temporary Emergency Exposure Limits (TEELs): Sodium carbonate: TEEL-0 = 10 mg/m^3 , TEEL-1 = 30 mg/m^3 , TEEL-2 = 50 mg/m^3, TEEL-3 = 500 mg/m^3

	No other country has an occupational exposure limit specifically for sodium and potassium carbonate, although many countries have assigned a generic TWA exposure limits of 10 mg/m^3 (inhalable dust), and 3 mg/m^3 (respirable dust) for particles not otherwise classified (PNOC).
Australian Food Standards	No data available.
Australian Drinking Water Guidelines	Sodium carbonate was endorsed by the National Health and Medical Research Council (NHMRC) for use as a drinking water treatment chemical in 1983 (NHMRC 2011). In water treatment, sodium carbonate is used mainly as a source of alkalinity and pH adjustment. Typical sodium carbonate concentrations used can vary from 5 to more than 500 mg/L, and the appropriate concentration is determined by laboratory trials.
Aquatic Toxicity Guidelines	No data available.
PBT Assessment[4,6]	
P/vP Criteria fulfilled?	Not applicable, inorganic substance, ubiquitous in environment.
B/vB criteria fulfilled?	Not applicable. Bioaccumulation is not applicable to these inorganic ions.
T criteria fulfilled?	No chronic toxicity data exist; however, the acute EC(L)50s are >0.1 mg/L. Thus, does not meet the screening criteria for toxicity
Overall conclusion	Not PBT

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Toxicity Summary - Acetic acid

Chemical and Physical Properties[1,4,6]	
CAS number	64-19-7
Molecular formula	$C_2H_4O_2$
Molecular weight	60 g/mol
Solubility in water	1000 g/L at 25°C
Melting point	16.6°C
Boiling point	117.9°C
Vapour pressure	1.5 kPa at 20°C
Henrys law constant	0.0101 Pa m^3/mol
Explosive potential	Above 39°C explosive vapour mixtures may be formed. Risk of fire and explosion on contact with strong oxidants.
Flammability potential	Flammable. Flashpoint = 39°C
Colour/Form	Clear colourless liquid with a pungent vinegar smell
Overview	Acetic acid is naturally occurring as the acid in apple cider vinegar and other fruit derived products. Acetic acid is recognised by Food Standards Australia New Zealand (FSANZ) and the US Food and Drug Administration (FDA) as safe as a food additives (e.g. flavouring agent, preservative). The Australian Industrial Chemicals Introduction Scheme (AICIS) concluded that this chemical pose no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework and thus required no further assessment.
Environmental Fate[2,3]	
Soil/Water/Air	When released into the environment, acetic acid is not expected to adsorb onto suspended solids or sediments. Acetic acid dissociates in aqueous media to H+ and the acetate anion ($CH_3CO_2^-$). The compound is expected to be present in the dissociated form, where volatilisation is not an important process. Based on the range of expected Koc values, acetic acid is expected to have a very high to moderate mobility in soil. In air acetic acid will exist solely in the vapour phase where it is degraded with photochemically produced hydroxyl radicals with a half-life for this reaction in air of approximately 22 days. Acetic acid is readily biodegradable, and biodegrades rapidly under aerobic and anaerobic conditions. Based on an estimated bioconcentration factor of 3.2, the potential for bioaccumulation is low.
Human Health Toxicity Summary[1,2,3,4,6]	
Chronic Repeated Dose Toxicity	In a six-month repeat dose oral toxicity study (Lamb and Evard 1919), pigs were initially fed acetic acid at 155 mg/kg bw/day with the dose was raised every 10 to 30 days until a final dose of 380 to 450 mg/kg bw/day was reached after 60 days. There was no mortality and no effects on body weight or acid-base balance noted in this study (REACH 2013). A NOAEL was not established in this study. Repeated intra-gastric administration of the chemical at 3% concentration in animals (unspecified) for six months resulted in chronic inflammation of the oesophageal mucosa (HSDB 2013). Similarly, intra-gastric administration to rats of 3 mL of a 10% solution for 90 days produced a drop in haemoglobin concentration and erythrocyte count (HSDB 2013). In another similar study, pigs were fed daily diets containing the chemical at 0, 240, 720, 960 and 1200 mg/kg bw/day for successive 30-day periods for a total of 150 days (HSDB 2013).There were no significant differences in growth rate, weight gain, early morning urinary ammonia and terminal blood pH between controls and test groups. A NOEL or NOAEL was not indicated by the authors. Based on the available information and taking a conservative approach, the NOAEL in the study is considered to be 1200 mg/kg

	bw/day, the highest tested dose with no adverse effects. This NOAEL will be used for human health risk assessment. In the only available dermal repeat dose toxicity study (Slaga et al. 1975), acetic acid was applied dermally to mice at doses of 1 to 40 mg/animal, one to three times/week for 32 weeks. Single dermal applications of acetic acid at doses of up to 40 mg/animal did not induce mortality. However, more than one application per week of 10 mg acetic acid or more caused excessive mortality. 33% of mice died when 10 mg acetic acid/animal was applied dermally three times/week and approximately 50% of mice died when 20 mg was applied twice a week. No biochemical or histopathological effects were reported. A LOAEL of 10 mg/animal was suggested by the authors, however it was expressed in terms of 'mg/animal' rather than 'mg/kg bw/day' and it therefore cannot be adopted. Dermal NOAEL or LOAEL for acetic acid are not available. Repeated oral, inhalation and dermal exposure of humans to pure acetic acid has been reported to have effects on the gastrointestinal tract and to cause digestive disorders including heartburn and constipation, chronic inflammation of the respiratory tract, pharyngitis, catarrhal bronchitis, darkening of skin, skin dermatitis and erosion of the exposed front teeth enamel. In addition, skin on the palms of hands can become dry, cracked and hyperkeratotic. These observed effects were not associated with any systemic findings, suggesting the effects observed could be due to its corrosive action (EC 2012; HSDB 2013).
Carcinogenicity	In a carcinogenicity study (Slaga et al. 1975), acetic acid was tested as the promoter for tumour development in mice. Acetic acid was applied dermally to mice initiated with a carcinogenic agent, dimethylbenz(a)anthracene (DMBA) at doses of 1 to 40 mg/animal, one to three times/week for 32 weeks. Control animals received acetic acid dermally once per week. No further details were provided about the exposure duration. Single dermal application of acetic acid at doses of up to 40 mg/animal did not induce mortality. However, more than one application per week of 10 to 40 mg acetic acid caused excessive mortality. Thirty three per cent of mice died when 10 mg acetic acid/animal was applied dermally three times/week and approximately 50% of mice died when 20 mg was applied twice a week. No biochemical or histopathological effects were reported. Acetic acid did not produce any carcinogenic effects in mice (REACH 2013). In another study, oral administration of the chemical as a 3% solution in rats, three times/week for eight months did not induce tumours in the oesophagus and fore-stomach, although epithelial hyperplasia was observed. When dosed in combination with the known carcinogen, N-nitrososarcosine ethyl ester (positive control), there was an increase in oesophageal/stomach tumour formation (REACH 2013). Based on the limited available data, acetic acid is not likely to be a carcinogen.
Mutagenicity/ Genotoxicity	Acetic acid was not mutagenic in bacterial reverse mutation assays using Salmonella typhimurium strains TA100, TA1535, TA97 and TA98 with and without metabolic activation (Ishidate et al. 1984). Acetic acid was negative in the chromosome aberration assay using Chinese hamster lung fibroblasts at concentrations of up to 1 mg/mL with or without metabolic activation. In one study using Chinese hamster ovary KI cells, acetic acid induced chromosomal aberrations at the initial pH of 6.0 or below (about 10 to 14 mM of acid) both with and without S9 mix (REACH 2013). However, when the culture medium was neutralised to pH 7.2 with sodium hydroxide, no clastogenic activity was observed. Moreover, pH lower than 6.0 (pH 5.7 or below) were also found to be cytotoxic. Chromosomal aberrations induced at these high concentrations were therefore considered to be artefacts due to acidification of the culture medium. Acetic acid was concluded not to be clastogenic when tested in cultured Chinese hamster K1 cells (REACH 2013; HSDB 2013). It was concluded that acetic acid is not mutagenic.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	In two developmental toxicity studies conducted according to the EU Method B.31 (prenatal developmental toxicity study), acetic acid was administered by gavage to pregnant female Wistar rats and CD-1 mice at 16, 74.3, 345, and 1600 mg/kg bw/day during gestation days 6 to 15 (10 consecutive doses) (REACH 2013). In a

	similar study, the chemical was administered by gavage to female Dutch rabbits at 16, 74.3, 345, and 1600 mg/kg bw/day during gestation days 6 to 18 (13 consecutive doses) (REACH 2013). There were no clearly discernible effects on implantation, maternal survival or foetal survival in any species at any of the doses. The number of abnormalities seen in either soft or skeletal tissues of the test groups did not differ significantly from those occurring spontaneously in the controls. No NOAEL could be established for maternal toxicity or foetal developmental effects. Based on the available data, the chemical does not show developmental toxicity.
Acute Toxicity	Acetic acid was of low acute toxicity in animal tests following oral exposure. The median lethal dose (LD50) observed in two rat studies is greater than 2000 mg/kg bw (REACH 2013). In one study, groups of unfasted rats were fed 2239, 2512, 2859, 3100, 3500, 4000, 4467 mg/kg bw sodium acetate and observed for six days (REACH 2013). The acute oral median lethal dose (LD50) of the sodium salt of acetic acid was found to be 3310 mg/kg bw for rats. Acetic acid was of moderate acute toxicity in rabbits following dermal exposure. The LD50 in rabbits was 1060 mg/kg bw (HSDB 2013). Details regarding the concentration of the administered test substance were not provided. The moderate acute dermal toxicity is believed to be due to its local corrosive effects rather than any systemic toxicity. Acetic acid was of low acute toxicity in animal tests following inhalation exposure. In an acute inhalation study, mice were exposed to various concentrations of acetic acid (experimental details and concentration range not provided) (HSDB 2013). Clinical signs of respiratory irritation were evident at concentrations of 2.46 mg/L and higher. Animals exposed to concentrations higher than 11.07 mg/L died within 27 hours of exposure. Surviving mice recovered quickly and showed no abnormalities three days after exposure. The median lethal concentration (LC50) was determined by the Weil's method and was estimated to be 13.8 mg/L in the mouse. Severe health effects have been reported in humans following accidental exposure to acetic acid by different routes, mainly due to the local corrosive effects of the chemical leading to systemic effects (HSDB 2013).
Irritation	Pure acetic acid is corrosive to skin. In animal studies, severe skin burns were reported in guinea pigs following application to intact or abraded skin of patches of 80% solution of the chemical, moderate to severe burns at 50 to 80% solution, mild injury at 50% solution, and no effect at 10% solution (HSDB 2013). In a study with rabbits, the chemical was considered to be slightly irritating at concentrations of 3.3% and 10% (REACH 2013). In another study with rabbits, a concentration of 2.5% of the chemical was not irritating while concentrations of 10 to 25% caused moderate to severe erythema, slight to severe oedema, skin lesions over the application site and eschar formation (REACH 2013). A 10% solution was therefore considered a skin irritant. As part of a study to select the optimum testing conditions for predicting hazard to the human eye, 3%and 10% aqueous acetic acid were tested in rabbit eyes (REACH 2013). Materials were applied directly to the central corneal surface. Irritation was followed for up to 21 days and scored according to the Draize scale. The 3% acetic acid gave moderate irritation and 10% acetic acid was severely irritating or corrosive. In other studies, instillation of 0.5 mL of a 1% acetic acid solution in the eyes of rabbits caused a severe burn (Smyth et al. 1951). Solutions of 5% induced injury in eyes of rabbits which healed by 14 days, while a 10% solution resulted in severe permanent damage (Henschler 1973). Based on the results of the studies pure acetic acid is considered to be corrosive to eyes. In an acute inhalation study in mice, clinical signs of respiratory irritation were evident at concentrations of 2.46 mg/L and higher (see Section A28.5.2.3). Acetic acid vapours were reported to cause damage to nose, throat and lungs in humans (SCOEL 2012). Acetic acid is considered to be a respiratory tract irritant.

	Chemical burns and eye and nasal irritation have been reported in humans following exposure.
Sensitisation	No experimental data were available, however the US National Institute of Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards mentions skin sensitisation as one of the symptoms of acetic acid exposure (NIOSH 2010). A 1994 report (Kivity et al. 1994) describes a late asthmatic response to inhaled glacial acetic acid by an asthma patient. Based on reports of patients with bronchial asthma reacting to acetic acid challenge, it is believed that acetic acid may cause allergic reactions in humans (HSDB 2013). Some researchers consider acetic acid capable of causing a syndrome known as 'reactive airways dysfunction', which resembles bronchial asthma. Symptoms include dyspnoea, wheezing, and cough.
Health Effects Summary	Acetic acid has low acute oral and inhalation toxicity but moderate dermal toxicity. LD50 for oral, dermal and inhalation routes were >3100 mg/kg bw, 1060 mg/kg bw and 13.8 mg/L, respectively in laboratory animals. It is corrosive to skin, eyes and respiratory tract. Acetic acid has low repeat dose toxicity by oral and dermal routes. Information on toxicity by the inhalation route is not available. It is not genotoxic or carcinogenic and does not have any developmental effects in animals. Information on effects on fertility is not available. The critical health effect of acetic acid for risk characterisation is its corrosivity.
Key Study/Critical Effect for Screening Criteria	A NOEL or NOAEL was not established in any of the repeat dose studies. Based on the available information and taking a conservative approach, the highest tested dose with no adverse effects in the repeat dose oral study (1200 mg/kg bw/day) was taken as the NOAEL for human health risk assessment.
Ecological Toxicity[2]	
Aquatic Toxicity	Acute endpoints: Fish = 75 mg/L (measured), Daphnia EC50 = 32 mg/L (Dept. Env. (2013a) in LMC, 2012 Chronic endpoints: Daphnia = 150 mg/L (measured)
Determination of PNEC aquatic	The Australian Industrial Chemicals Introduction Scheme (AICIS) concluded that this chemical pose no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework and thus required no further assessment.
Current Regulatory Controls[1,5,6]	
Australian Hazard Classification	Acetic acid is classified as hazardous, with the following risk phrase for human health in the Hazardous Chemical Information System (HCIS) (Safe Work Australia 2013): Flammable liquid – category 3 Skin corrosion – category 1A Mixtures containing the chemical are classified as hazardous with the following risk phrases based on the concentration (Conc) of the chemical in the mixtures: Conc >=90%: C; R35 (Corrosive, causes severe burns) ≥25% Conc <90%: C; R34 (Corrosive, causes burns) ≥10% Conc <25%: Xi; R36/38 (Irritant, Irritating to eyes and skin).
Australian Occupational Exposure Standards	The chemical has an exposure standard of 25 mg/m^3 (10 ppm) Time Weighted Average (TWA) and 37 mg/m^3 (15 ppm) Short-Term Exposure Limit (STEL) (Safe Work Australia 2013).
International Occupational Exposure Standards	The following exposure standards are identified in Galleria Chemica (2013). Occupational Exposure limit (TWA): 10 to 25 mg/m^3 [China, Canada, Denmark, Germany, Ireland, South Africa, Spain, Sweden, Switzerland, and the US]. An exposure limit (STEL): 15 to 50 mg/m^3 [China, Canada, France, Ireland, Singapore, South Africa, Spain, Sweden, Switzerland, and the US].
Australian Food Standards	Acetic acid is allotted the following International Numbering System of food additives number:

	INS 260 (Food Standards Australia New Zealand 2013).
Australian Drinking Water Guidelines	No data found.
Aquatic Toxicity Guidelines	No data found.
PBT Assessment	
P/vP Criteria fulfilled?	No. The acetate ion of acetic acid is readily biodegradable and thus it does not meet the screening criteria for persistence.
B/vB criteria fulfilled?	The log Kow for acetic acid is reported to be -0.136. Acetate is also found in the body and is metabolized as part of the body's biochemical pathways. Thus, acetic acid (specifically, the acetate ion) does not meet the screening criteria for bioaccumulation.
T criteria fulfilled?	No. The NOECs from the chronic aquatic toxicity data on acetic acid are >1 mg/L, hence does not meet the screening criteria for toxicity.
Overall conclusion	Not PBT

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Toxicity Summary - 2-hydroxy-N,N,N-trimethylethanaminium

Chemical and Physical Properties[1,2,3,4]	
CAS number	67-48-1
Molecular formula	$C_5H_{14}NOCl$
Molecular weight	139.63 g/mole
Solubility in water	Very soluble in water and alcohol
Melting point	247°C
Boiling point	Decomposition upon heating
Vapour pressure	6.57 x 10^{-8} Pa at 25°C
Henrys law constant	2.06*10E-11 Pa*m³/mole at 25°C
Explosive potential	Not explosive
Flammability potential	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.
Colour/Form	white crystalline solid
Overview	Choline chloride is a quaternary amine salt, it dissociates in water into the corresponding positively charged quaternary hydroxyl alkylammonium ion and the negatively charged chloride ion. Choline chloride has neither explosive nor oxidizing properties due to its molecular structure Choline is a dietary component and found in foods as free choline and as esterified forms such as phosphocholine, glycerophosphocholine, sphingomyeline, and phosphatidylcholine. It functions as a precursor for acetylcholine, phospholipids, and the methyl donor betaine and is important for the structural integrity of cell membranes, methyl metabolism, cholinergic neurotransmission, transmembrane signalling, and lipid and cholesterol transport and metabolism. Evidence from animal studies and from human exposure indicates that choline chloride has low toxicity, is not mutagenic and has no developmental toxicity. This is not unexpected in view of its presence in the diet and its production in metabolic processes in the body; it fulfils key roles in nerve transmission, cell membrane integrity, and lipid metabolism. Only limited animal data are available on effects on fertility, but the normal exposure of humans to appreciable amounts of choline chloride both from the diet and formed from normal metabolic processes, would argue against it having any significant adverse effects on fertility. This is supported by the fact that it has been widely used as an animal feed additive for decades with no apparent adverse effects being noted on fertility. A Tier 1 Human Health Assessment for this chemical has been conducted by NICNAS which concluded that this chemical was identified as low concern to human health.
Environmental Fate[1,3,4]	
Soil/Water/Air	Distribution modelling using Mackay Level I indicates water (100 %) to be the main target compartment. The amount in the other compartments is with < 0.0001 % negligible. Choline chloride is readily biodegradable according to OECD-criteria (MITI-I Test; BOD measurements) reaching 93 % degradation within 14 days. Due to the chemical structure hydrolysis can be excluded. In the atmosphere choline chloride will be rapidly degraded according to a half-life time (t½) of about 6.9 hours for hydroxyl-radicals based on a 12 hours day. Due to the measured and calculated logKow of –3.77 and –5.16 both at 25°C, respectively, and a calculated logKoc of 0.37 a bio- or geoaccumulation is not to be expected.
Human Health Toxicity Summary [1,3,4,5]	
Chronic Repeated Dose Toxicity	A 72-week feeding study was conducted to investigate the impact of choline chloride on the liver tumour promoting activity of phenobarbital and DDT in diethylnitroamineinitiated Fischer 344 rats (Shivapurkar *et al.*, 1986). Animals received approximately 500 mg/kg-day choline chloride. Following the end of the

	exposure period, the animals were kept on the same untreated diet as the control group until study termination at week 103. Histopathology was limited to the liver and organs that developed gross abnormalities. There were no significant differences between treated and control animals on survival rates, body weights, and relative liver weights. Neither was there any increased number of neoplastic liver nodules, hepatocellular carcinomas, lung tumours, leukaemia nor other tumours between treated and control animals. The NOAEL for choline chloride in this study is 500 mg/kg/day In humans, oral administration of 10,000 mg/day choline chloride in a pilot study treating a small number of patients with Alzheimer's disease, resulted in a slight hypotensive effect (Boyd *et al.*, 1977). This dose was regarded as a LOAEL by the Standing Committee on the Scientific Evaluation of Dietary Reference Intake (2000).
Carcinogenicity	No studies were located.
Mutagenicity/ Genotoxicity	Choline chloride was not mutagenic to bacteria in reverse mutation assays (Haworth *et al.*, 1984; JETOC, 1997; Litton Bionetics, 1977). A small, but statistically significant, and dose-related increase in sister chromatid exchanges (SCEs) in Chinese Hamster Ovary (CHO) cells was reported at 50 and 500 µg/ml choline chloride in the absence of S9 only (Bloom *et al.*, 1982). No higher concentrations were examined. These results could not be confirmed in another study using CHO cells at concentrations of choline chloride up to 5,000 µg/ml. (Galloway *et al.*, 1985). In a gene conversion assay with *Saccharomyces cerevisiae* strain D4, choline chloride was negative in the presence and absence of metabolic activation (Litton Bionetics, 1977). No *in vivo* genotoxicity studies were available.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	Pregnant female mice were given in their feed 1,250 to 20,000 mg/kg choline chloride during gestational days 1 to 18 (BASF AG, 1966). Maternal body weight gain was reduced in all treated groups except for the 1,250 mg/kg group. Determination of maternal weight gain of dams with embryonic/foetal absorptions showed that there was no All foetuses were resorbed in the 20,000 mg/kg group. Embryonic/foetal lethality of 35% and 69% were seen in the 4,160 and 10,800 mg/kg groups, respectively. No resorptions occurred in the 1,250 mg/kg group. Developmental toxicity was seen in all but the 1,250 mg/kg group. No statistically significant increases in malformations were observed in any dose group. The NOAELs for maternal and developmental toxicity is 1,250 mg/kg/day.
Acute Toxicity	The oral LD50 in rats was reported to be between 3,150 and 5,000 mg/kg (BASF AG, 1963a, 1969).
Irritation	Application of a 70% aqueous solution to the skin of rabbits for 20 hours under occlusive conditions resulted in only minor skin irritation (BASF AG, 1963b). Slight eye irritation was seen in the eyes of rabbits after instillation of a 70% aqueous solution of choline chloride; no effects were seen one day after exposure (BASF AG, 1963c).
Sensitisation	No data are available in animals. In a Human Repeated Insult Patch Test, there was no evidence of dermal sensitization in two hundred subjects given 0.5% (w/v) aqueous solution of choline chloride during the induction phase and 0.2% (w/v) aqueous solution during the challenge phase (Colgate-Palmolive, 2003).
Health Effects Summary	This chemical has been identified by NICNAS to be of low concern to human health.
Key Study/Critical Effect for Screening Criteria	The Standing Committee on the Scientific Evaluation of Dietary Reference Intakes selected hypotension as the critical effect from the study by Boyd *et al.* (1977) when deriving a Tolerable Upper Intake Level. Boyd *et al.* (1977) reported a LOAEL of 10,000 mg/day choline chloride (7,500 mg/day choline). An uncertainty factor of 2 was chosen because of the limited data regarding hypotension and the inter-individual variation in response to cholinergic effects. Thus, the value for the Tolerable Upper Intake Value for repeated exposure of adults to choline is 3,500 mg/day choline. The oral RfD for choline chloride is derived by using the LOAEL of 10,000 mg/day from the Boyd *et al.* (1977) study, which is divided by an uncertainty factor of 2, to obtain a value of 5,000 mg/day or 71 mg/kg/day for a 70 kg person. Oral RfD = 71 mg/kg/day Drinking water guideline value = 248 ppm
Ecological Toxicity [4]	

Aquatic Toxicity	The 96-hour fish LC50 value is >100 mg/L (nominal and measured) in *Oryzias latipes* (MOE Japan, 1999a), and the 48-hour in vertebrate EC50 is 349 mg/L (nominal and measured) in *Daphnia magna* (MOE Japan, 1999b). The 72-hour EC50 to *Pseudokirchneriella subcapitata* is >1,000 mg/L (nominal and measured) based on growth rate; the 72-hour NOEC is 32 mg/L (MOE Japan, 1999c). In a 21-day *Daphnia magna* reproduction test, the nominal and measured NOEC was reported to be 30.2 mg/L (MOE Japan, 1999d).
Determination of PNEC aquatic	PNECaquatic: Experimental results are available for three trophic levels. Acute E(L)C50 values are available for fish (>100 mg/L), invertebrates (349 mg/L), and algae (>1,000 mg/L). Results from chronic studies are available for invertebrates (21-day NOEC = 30.2 mg/L) and algae (72-hour NOEC = 32 mg/L). On the basis that the data consists of chronic studies on two trophic levels, an assessment factor of 10 has been applied to the lowest reported NOEC of 30 mg/L for Daphnia. The PNECaquatic is 3.02 mg/L.
Current Regulatory Controls	
Australian Hazard Classification	No data found.
Australian Occupational Exposure Standards	No data found.
International Occupational Exposure Standards	No data found.
Australian Food Standards	No data found.
Australian Drinking Water Guidelines	No data found.
Aquatic Toxicity Guidelines	No data found.
PBT Assessment[1,4]	
P/vP Criteria fulfilled?	Choline chloride is readily biodegradable and thus it does not meet the screening criteria for persistence.
B/vB criteria fulfilled?	Based on a measured log Kow of -3.77 and a calculated BCF of 0.59, choline chloride does not meet the screening criteria for bioaccumulation.
T criteria fulfilled?	The chronic toxicity data on choline chloride show NOECs of >0.01 mg/L. Thus, choline chloride does not meet the screening criteria for toxicity.
Overall conclusion	Not PBT

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Toxicity Summary - [redacted]

Chemical and Physical Properties[1,2,3,4]	
CAS number	[redacted]
Molecular formula	UVCB
Molecular weight	298.42 - 344.49
Solubility in water	292 g/L at 20°C
Density	1.054 g/cm^3 at 20°C (1.054 kg/L)
Melting point	240°C
Boiling point	≥388°C
Vapour pressure	0 Pa at 25°C
Henrys law constant	0.068 Pa.m^3.mol-1 at 25°C
Explosive potential	Non-explosive
Flammability potential	Non flammable
Colour/Form	Solid, powder
Overview	This group of chemicals [redacted] CAS No [redacted] and s[redacted] are anionic surfactants that are manufactured by sulfoxidation of n-paraffins (HERA, 2002). The chemicals in this group contain the common structural feature of a predominantly linear aliphatic hydrocarbon chain with a polar sulfate or sulfonate group, with a sodium counterion. The hydrocarbon chain (with a length between C12 and C18) and the presence of the polar sulfate or sulfonate groups give the surfactant the chemicals' properties and enable them to be used commercially as anionic surfactants (OECD, 2007; NICNASa; NICNASb). The cation is not expected to affect the chemical reactivity and the hazard classification for the purpose of this assessment. Given the close structural similarities and surfactant properties of this group of chemicals, identical hazard profiles for human health are expected. These chemicals also have similar reported uses.
Environmental Fate[4]	
Soil/Water/Air	Deduced from physico-chemical and surfactancy properties the target compartment for the substances of this category is the hydrosphere. Based on the ionic structure partitioning into the atmosphere can be excluded. In water, the compounds are stable to hydrolysis under environmental conditions. Soil sorption increases with chain length. Strong sorption on soils would be expected for chain length 14 upwards. Sediment concentrations were between 0.0035 and 0.021 mg/kg dw indicating that accumulation in sediments is low. Under certain conditions of reduced moisture in soil, i.e. in arid or semi-arid regions, accumulation in soil cannot be excluded.
Human Health Toxicity Summary[1]	
Chronic Repeated Dose Toxicity	Oral Based on the available data, the chemicals in this group are not considered to cause serious damage to health following repeated oral exposure. In a 90-day feeding study, rats (strain and number not specified) were fed sodium AOS at doses of 40, 200 or 1000 mg/kg/day. A slight increase in the relative liver weight ratio was observed in animals at the highest dose group. No other treatment-related changes were observed (Arthur D Little, Inc., 1993). In a 91-day feeding study, groups of rats (strain and number not specified) received sodium AOS (34 % active) at doses of 50, 150 or 500 mg/kg. No treatment-related effects or histopathological changes were observed. No further details were provided (Arthur D Little, Inc., 1993). In a 104 week study, Sprague Dawley (SD) rats (50 animals/sex/group) were fed sodium AOS at doses of 0, 39, 96 or 195 mg/kg bw/day for males and 0, 57, 132 or 259 mg/kg bw/day for females. No treatment-related systemic effects were

	observed in the low or mid-dose test groups. In the highest dose group, slight decreases in body weight gain and food intake during the first year of treatment were reported. A no observable adverse effect level (NOAEL) of 96–132 mg/kg bw/day and a lowest observed adverse effect level (LOAEL) of 195–259 mg/kg bw/day were established in this study (OECD, 2007). Repeated oral administration of alkyl sulfates with chain lengths between C12 and C18 resulted in local irritation at the site of first contact (irritation of the fore stomach). The target organs for systemic toxicity are the liver (increased liver weight, enlargement of liver cells, and increased liver enzyme levels) and the kidneys (increased relative kidney weights). In a 13-week dietary study in rats, an LOAEL of 123 mg/kg bw/day based on liver toxicity, and an NOAEL of 61 mg/kg bw/day were determined for C16–18 sodium AS. An NOAEL of 116 mg/kg bw/day and an LOAEL of 230 mg/kg bw/day were determined in rats administered with C12 sodium AS in a 13-week study (HERA, 2002; OECD, 2007). <u>Dermal</u> Based on the available data, the chemicals in this group are considered not to cause serious damage to health following repeated dermal exposure. Dermal administration resulted in local effects consisting of skin irritation at the site of dermal contact. In a repeated dose dermal toxicity study, sodium AOS was applied to rabbit skin at 0.5 or 1 % daily for 14 days. No skin irritation was reported (Arthur D Little, Inc., 1993; REACHa). In another study, sodium AOS was applied to rabbit skin at 1 % daily for 28 days. No skin irritation effects were observed on intact skin (REACHa). In a 91-day study, a 2 mL/kg/day aqueous solution of sodium AOS (34 % active), when applied to the backs of rabbits, showed mild to moderate skin irritation (Arthur D Little, Inc., 1993; REACHa). In a cumulative open patch test, sodium AOS at 2 % in an aqueous solution was applied to guinea pig skin twice daily for nine applications. Slight to moderate skin irritation was reported (Arthur D Little, Inc., 1993; REACHa). Repeated dermal administration in mice of sodium C12-15 AS for 21 days (up to 18 % in water) or 13 weeks (up to 15 % in water) resulted in increased relative liver and kidney weights. An NOAEL of 10 % (approximately 400 mg/kg bw/day) for systemic toxicity was determined. For dermal toxicity, a NOAEL of 5 % (approximately 200 mg/kg bw/day) and an LOAEL of 10 % (approximately 400 mg/kg bw/day) were determined based on thickening of the skin, ulceration and necrosis of the epidermis at doses greater than 10 % (HERA, 2002; OECD, 2007).
Carcinogenicity	The available information indicates that the chemicals in this group are not carcinogenic.
Mutagenicity/ Genotoxicity	Based on the available information, the chemicals in this group are not genotoxic in either in vitro or in vivo studies.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	The chemicals did not show specific reproductive or developmental toxicity. Any reproductive or developmental effects were only observed secondary to maternal toxicity (OECD 2007; NICNASa; REACHa; REACH). Data on SLS are provided as read across since SLS has similar physico-chemical properties and reactivity to sodium AOS and sodium AS. Two generational studies were conducted in pregnant rats (20/dose), mice (20/dose) and rabbits (13/dose). The rodents were treated with sodium AOS by gavage on gestation days (GD) 6–15; while rabbits were treated on GD 6–18. The treatment doses were 0.2, 2, 300 or 600 mg/kg bw/day. No signs of maternal toxicity were observed in any of the treated rats. All rabbits dosed with 600 mg/kg bw/day and one dam dosed with 300 mg/kg bw/day died during the study (HERA, 2002; Palmer et al., 1975; REACHa). In a number of developmental and reproductive studies, oral administration of sodium AOS did not cause embryotoxic, foetotoxic or teratogenic effects in rats. However, reproductive and developmental effects were observed in mice and rabbits secondary to maternal toxicity. No further details were provided (OECD, 2007; REACHa). In a reproductive study, Swiss albino male mice were fed with SLS either at 1 % (corresponds to 1000 mg/kg bw/day) for two weeks, or with 0.1% for six weeks (corresponds to 100 mg/kg bw/day). The study concluded that SLS has no adverse effects on fertility when administered at concentrations sufficient to cause a

	significant reduction in body weight (parental toxicity). An NOAEL of 1000 mg/kg bw/day (in males) for fertility was reported for the study (NICNASa). In a developmental study using female rats, SLS was administered by oral gavage at 0, 63, 125, 250 or 500 mg/kg bw/day, on GD 6–15. Maternal toxicity was observed at the highest dose; however, no signs of developmental toxicity were reported. The NOAELs for maternal and developmental toxicity were reported to be 250 and >500 mg/kg bw/day, respectively (NICNASa). In another developmental study using female CD rats, SLS was administered by oral gavage at 0, 0.2, 300 or 600 mg/kg bw/day on GD 6–15. SLS did not cause developmental toxicity at doses up to 600 mg/kg bw/day. Maternal toxicity was observed at 300 mg/kg bw/day. The NOAEL for developmental toxicity was reported to be 600 mg/kg bw/day. In a similar study, mice (CD-1) and rabbits (New Zealand White) were administered by oral gavage with the same doses as above. Maternal toxicity was observed at 300 mg/kg bw/day in both species. The NOAEL for developmental toxicity was reported to be 300 mg/kg bw/day based on total resorption and/or increased incidence of litter loss at the 600 mg/kg bw/day dose in both species (NICNASa).
Acute Toxicity	<u>Oral</u> The chemicals in this group have low to moderate acute toxicity, based on results from animal tests following oral exposure. The median lethal doses (LD50) ranged from 1.4 to 7.8 g/kg (1400 to 7800 mg/kg) in rats and 2.6 to >8 g/kg (2600 to 8000 mg/kg) in mice (HERA, 2002; OECD 2007; REACHa). Mortality was reported in animals following acute oral exposure to the chemicals at concentrations ranging from 1807 to 4000 mg/kg bw. Clinical observations included impaired gastrointestinal tract, stomach tightly filled with brownish fluid and foam, dark red content of the gastric mucosa and the colon, and minor petechial bleeding in the lung. <u>Dermal</u> The chemicals in this group have low dermal toxicity, based on results from animal tests following acute dermal exposure. The LD50 for sodium AOS was reported to be >6000 mg/kg bw in rabbits (HERA, 2002; OECD, 2007; REACHa). No data were available on dermal toxicity for sodium alkyl sulfate. However, it is expected that AS will have low dermal toxicity based on similarities in physico-chemical properties and toxicokinetics with sodium AOS and sodium lauryl sulfate (SLS; CAS No. 151-21-3) (NICNAS a). <u>Inhalation</u> Based on the available information for sodium AOS, the chemicals in this group have low acute toxicity following inhalation exposure. In an acute inhalation toxicity study similar to OECD Test Guideline (TG) 403, rats (unknown strain) (10 animals/dose) were exposed to 90 % of sodium AOS as a powdered aerosol for one hour. Clinical observations were made for up to 14 days post administration. No mortalities were reported and the median lethal concentration (LC50) was reported to be >229 mg/L (equivalent to >52 mg/L for a four-hour exposure of the undiluted chemical) (REACHa).
Irritation	<u>Skin irritation</u> Based on the available information, the chemicals in this group are considered skin irritants warranting hazard classification. Data on SLS are also provided as read across, since SLS has similar physico-chemical properties and reactivity to sodium AOS and sodium AS. In a skin irritation study conducted on six New Zealand White rabbits, 0.5 mL of sodium AOS solution (38 % active) was applied dermally to shaved, intact and abraded skin for 24 hours under occlusion. The treated site was not washed after the test substance was removed. Very slight irritation was observed on intact skin in 5/6 animals. One of the six animals had welldefined erythema, which had completely reversed by 72 hours after dosing. Five of the six animals showed well-defined erythema on the abraded skin at 24 hours after dosing. Very slight erythema in all animals and oedema in 2/6 animals were reported, which persisted after 72 hours post dosing on abraded skin (REACHa). In another skin irritation study conducted in six New Zealand White rabbits, 0.5 mL of sodium AOS solution (38 % active) was applied dermally to shaved, intact and abraded skin for four hours under semi-occlusion. The applied site was washed to

	remove the test substance. All six animals showed moderate to severe reactions with eschar formation, one with cracking at the treatment site at 72 hours after dosing. The reactions were slightly worse in abraded skin than intact skin (REACHa). In an irritation study conducted according to OECD TG 404, 0.5 g of sodium AS powder (88.7 % purity) was applied dermally (semi-occlusive) to three New Zealand White rabbits for four hours. Erythema and moderate oedema were observed up to seven days after the patches were removed. All signs of irritation were completely resolved 14 days after dosing (REACH). Skin irritation (erythema and oedema) was also reported following a four-hour application of 5–25% SLS solution on intact rabbit skin (NICNASa). SLS is classified as hazardous with the risk phrase 'Irritating to skin' in the HSIS (Safe Work Australia). <u>Eye irritation</u> The chemicals in this group are considered severe eye irritants warranting hazard classification. Data on SLS are provided as read across since SLS has similar physico-chemical properties and reactivity to sodium AOS and sodium AS. In an eye irritation study conducted according to OECD TG 405, 0.1 mL of sodium AOS (30% active) was applied to the eyes of three New Zealand White rabbits and observed for 21 days. Observed effects included slight corneal redness, slight iritis and conjunctival effects (erythema, swelling and chemosis). Except for chemosis, all eye irritation effects persisted for up to 21 days (REACHa). In another eye irritation study conducted in six New Zealand White rabbits, 0.1 mL of sodium AOS (38% active) was applied to the eyes with or without washing. Observation times were 24, 48 and 72 hours after administration. Eye irritation effects, which persisted for up to 72 hours, were reported (REACHa; HERA 2002). The eyes of three New Zealand White rabbits were treated with concentrated (0.08 mL of 90 % solution) sodium AOS. The test material was washed off and effects were observed at 24, 48 and 72 hours after application. Observed effects included clear to diffused beefy red erythema and severe swelling of the conjunctivae. Circumcorneal injection (enlargement of the ciliary and conjunctival blood vessels), corneal opacity and discharge (colourless, which changed to white viscous discharge) were also reported. The effects persisted for up to 21 days after dosing (REACHa). Sodium AS administered at 6 % resulted in eye irritation in rabbits, which was reversible within 72 hours of dosing (REACH). The chemical, SLS at 25% in an aqueous solution caused eye irritation in rabbit eyes, which were not reversible within the 21-day observation period (NICNASa). SLS is classified as hazardous with the risk phrase 'Risk of serious damage to eye' in the HSIS (Safe Work Australia).
Sensitisation	Based on the available information, the chemicals in this group are not skin sensitisers. Data on SLS are provided as read across since SLS has similar physico-chemical properties and reactivity to sodium olefin sulfonate and sodium alkyl sulfate. [redacted] did not induce sensitisation reactions in several guinea pig maximisation tests or in a Buehler test (HERA, 2002; OECD, 2007; REACHa; REACH). The chemical, SLS produced positive reactions in 2/3 local lymph node assays (LLNA). However, the observed increase in cell proliferation was caused by a non-antigen-specific proliferative stimulus induced by the irritating effect of the tested SLS concentrations (4, 5, 10 or 25 %). SLS was not considered as a skin sensitiser (NICNASa).
Health Effects Summary	The critical health effects for risk characterisation are local effects including skin irritation and the possibility of causing serious damage to eyes.
Key Study/Critical Effect for Screening Criteria	The key study chosen is the chronic oral repeated dose 104-week rat studies where the lowest NOAEL was 96 mg/kg bw/day. Uncertainty factors: 10 (interspecies variability); 10 (intraspecies variability) Oral RfD = 96/100 = 0.96 mg/kg/dayDerived drinking water guideline value = 3.744 mg/L
Ecological Toxicity[2]	
Aquatic Toxicity	Short-term tests are available for aquatic invertebrates (freshwater as well as marine species), algae and fish. The endpoints for the three relevant aquatic

<table>
<tr><td></td><td>trophic levels are in the same order of magnitude. The LC50 (48 h) for Ceriodaphnia conforms dubia was 4.53 mg/L (Warne & Schifko, 1999) and 2.08 mg/L (calculated for 100% substance) for Acartia tonsa. For algae, the EC50 (72 h) was determined to be 1.97 mg/L (calculated for 100% substance) (Hushagen, 1997). The LC50 (96 h) for zebra fish (Danio rerio) resulted in 4.2 mg/L (Markert & Weigand, 1984).
One chronic result within a 21-d reproduction study is available with a NOEC of 2.42 mg/L (calculated for 100 % substance) for Daphnia magna.
The NOEC for algae was 1.2 mg/L calculated for 100% substance. The effect concentration is within the range obtained in tests on acute toxicity.</td></tr>
<tr><td>Determination of PNEC aquatic</td><td>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 chronic endpoint of 2.42 mg/L for Daphnia. The PNECaquatic is 0.242 mg/L.</td></tr>
<tr><td colspan="2">Current Regulatory Controls[1]</td></tr>
<tr><td>Listed as a Chemical of Concern on International Databases</td><td>
<table>
<tr><th>International Database</th><th>Listed?</th></tr>
<tr><td>European REACH regulation Substances of very high concern (SVHCs) according to Annex XV
https://echa.europa.eu/candidate-list-table</td><td>No</td></tr>
<tr><td>International Agency for Research on Cancer (IARC) as a Group 1, 2A or 2B carcinogen
https://monographs.iarc.who.int/list-of-classifications</td><td>No</td></tr>
<tr><td>National Toxicology Program (NTP) Report on Carcinogens (RoC)
https://ntp.niehs.nih.gov/whatwestudy/assessments/cancer/roc/index.html</td><td>No</td></tr>
<tr><td>US EPA Integrated Risk Information System (IRIS) as carcinogenic to humans, or likely / probable / possibly carcinogenic to humans EU list chemicals with endocrine disruption listed in Category 1 or Category 2
https://www.epa.gov/iris</td><td>No</td></tr>
<tr><td>United States Endocrine Disrupter Screening Program
https://www.epa.gov/endocrine-disruption/endocrine-disruptor-screening-program-tier-1-screening-determinations-and</td><td>No</td></tr>
<tr><td>Agency for Toxic Substances and Disease Registry (ATSDR) as a neurotoxin
https://wwwn.cdc.gov/TSP/index.aspx?sysid=18</td><td>No</td></tr>
<tr><td>Montreal Protocol
https://www.dcceew.gov.au/environment/protection/ozone/montreal-protocol</td><td>No</td></tr>
<tr><td>Rotterdam Convention
http://www.pic.int/TheConvention/Chemicals/AnnexIIIChemicals</td><td>No</td></tr>
<tr><td>Stockholm Convention
http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx</td><td>No</td></tr>
</table>
</td></tr>
<tr><td>Australian Hazard Classification</td><td>The chemicals are not listed on the Hazardous Substances Information System (HSIS) (Safe Work Australia).</td></tr>
<tr><td>Australian Occupational Exposure Standards</td><td>No specific exposure standards are available.</td></tr>
<tr><td>International Occupational Exposure Standards</td><td>No specific exposure standards are available.</td></tr>
<tr><td>Australian Food Standards</td><td>No data available.</td></tr>
<tr><td>Australian Drinking Water Guidelines</td><td>No data available.</td></tr>
<tr><td>Aquatic Toxicity Guidelines</td><td>No data available.</td></tr>
<tr><td colspan="2">PBT Assessment[2,3,4]</td></tr>
<tr><td>P/vP Criteria fulfilled?</td><td>No. The substances of this category are readily biodegradable.</td></tr>
</table>

B/vB criteria fulfilled?	No. The Log Kow for the substance is -1.3 at 20 °C Thus, it does not meet the screening criteria for bioaccumulation.
T criteria fulfilled?	No. The NOEC from the chronic aquatic toxicity data on the substance is >0.01 mg/L, hence does not meet the screening criteria for toxicity.
Overall conclusion	Not PBT

References

1. Australian Industrial Chemicals Introduction Scheme (AICIS) online database. IMAP, Human Health Tier II Assessment for Selected anionic surfactants, Retrieved 2024: [redacted]
2. ECHA REACH, [redacted] Retrieved 2024: https://echa.europa.eu/.
3. OECD (2009). Screening Information Dataset (SIDS) Initial Assessment Report for [redacted] UNEP Publications. Retrieved 2024: [redacted]
4. Environment and Climate Change Canada, Health Canada, Screening Assessment [redacted]

Toxicity Summary - [redacted]

Chemical and Physical Properties[1,2,3,4,5]	
CAS number	[redacted]
Molecular formula	$(CH_2CCl_2)_x[CH_2CH(CO_2CH_3)]_y$
Molecular weight	Assumed to be greater than 1,000 Da
Solubility in water	Not soluble in water
Density	1.78
Melting point	No data found
Boiling point	80.2°C
Vapour pressure	86.3 mm/Hg at 25°C
Henrys law constant	No data found
Explosive potential	Stable under recommended storage and use conditions. Fine dusts of these resins are capable of forming.
Flammability potential	No data found
Colour/Form	White odourless granules
Overview	[redacted] This polymer is used extensively in packaging applications for food, pharmaceuticals, hygiene products, and sterilized medical products. It offers excellent barrier performance to moisture, oxygen, and doors. The resins are essentially non-irritating to the eyes and skin. Dust may cause temporary mechanical irritation to the skin and eyes under extreme conditions. However, it is considered to present no significant health hazard. The polymers are expected to be inert in the environment. They are unlikely to accumulate in the food chain, and are practically nontoxic to aquatic organisms on an acute basis. There is a significant lack of toxicological data related to this polymer and suitable surrogates are not readily available. The polymers are relatively stable and inert and unlikely to present health concerns based on chemical considerations. As this product is a granular substance, dusting potential and particulate inhalation (physical hazard) may warrant further investigation for occupational concerns and large-scale environmental release of the powder in close proximity to residential areas. This chemical has been identified by NICNAS to be of low concern to human health based on an initial screening approach and thus required no further assessment. Further assessment of the environmental risks from the use of this chemical is also not required.
Environmental Fate [1,2,3]	
Soil/Water/Air	[redacted] are inert polymers that are not soluble in water and will sink into sediment or float depending on product density. No appreciable biodegradation is expected, but surface photodegradation with exposure to sunlight and degradation due to mechanical action would be expected. [redacted] are not expected to accumulate in the food chain due to their relatively high molecular weight (bioconcentration potential is low). They are practically nontoxic to fish and aquatic organisms on an acute basis.
Human Health Toxicity Summary [1,3,4]	
Chronic Repeated Dose Toxicity	Repeated exposures to dusts are not anticipated to result in systemic toxicity or permanent lung injury, however, excessive exposures may cause less severe respiratory effects.
Carcinogenicity	No data found.

Mutagenicity/ Genotoxicity	No data found.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	No data found.
Acute Toxicity	No data found.
Irritation	Contact with solids or dusts may cause irritation or corneal injury due to mechanical action. Thermal degradation of the polymer may generate hydrogen chloride gas at concentrations that may cause eye irritation. Dust may cause irritation to upper respiratory tract (nose and throat). Thermal degradation of the resin may generate hydrogen chloride gas at concentrations that may cause respiratory irritation. Material has very low toxicity if swallowed. Harmful effects are not anticipated from swallowing small amounts.
Sensitisation	Brief contact is essentially non-irritating. Prolonged contact may cause slight irritation with local redness.
Health Effects Summary	This chemical has been identified by NICNAS to be of low concern to human health.
Key Study/Critical Effect for Screening Criteria	No data found.
Ecological Toxicity[2,3,5]	
Aquatic Toxicity	This polymer has no readily dissociable function groups and thus expected to be non-ionic species in the environment. The [redacted] copolymer is 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). As such, this polymer is expected to have low bioavailability and their adverse effects results 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). Therefore, this polymer is expected to have low toxicity to aquatic life.
Determination of PNEC aquatic	Not determined.
Current Regulatory Controls	
Australian Hazard Classification	No data found
Australian Occupational Exposure Standards	No data found
International Occupational Exposure Standards	No data found
Australian Food Standards	No data found
Australian Drinking Water Guidelines	No data found
Aquatic Toxicity Guidelines	No data found
PBT Assessment[1,3,4,6]	
P/vP Criteria fulfilled?	The polymers are synthetic addition polymers with stable carbon-chain backbones. If released to the environment, the polymers in this group are not expected to undergo rapid degradation, and are considered to be Persistent according to domestic hazard criteria (EPHC 2009).
B/vB criteria fulfilled?	Polymers with a NAMW greater than 1,000 Da cannot cross biological membranes (Nabholz 1997). Therefore, this polymer is considered to be not bioaccumulative according to domestic hazard criteria (EPHC 2009).

T criteria fulfilled?	No relevant toxicity data are available. This polymer is not expected to be toxic according to domestic environmental hazard criteria (EPHC 2009).
Overall conclusion	Not PBT

References

1. [redacted] Encyclopaedia of Chemical Technology, Fourth Edition, Vol. 24, John Wiley and Sons Inc. 1997.
2. [redacted] he Dow Chemical Company, 2005.
3. [redacted] 2013.
4. Sigma-Aldrich Co., (2011) Product Identification: [redacted] Sigma- Aldrich 3050 Spruce St.St. Louis, MO 63103. From [redacted] accessed September 2016.
5. Department of the Environment and Energy 2017, National assessment of chemicals associated with coal seam gas extraction in Australia, prepared by the National Industrial Chemicals Notification and Assessment Scheme

Toxicity Summary - Talc

Chemical and Physical Properties[1,4,5]	
CAS number	14807-96-6
Molecular formula	H2-O3-Si 3/4Mg or Mg3Si4O10(OH)2
Molecular weight	78.10 (estimate)
Solubility in water	Insoluble in water, cold acids or in alkalis
Density	2.7 g/cm^3 at 20 °C
Melting point	800-900°C (disintegration; WHO 2005)
Boiling point	549.7°C (estimate)
Vapour pressure	0 Pa at 25 °C
Henrys law constant	0 Pa m^3/mol at 25 °C and 101.325 kPa
Explosive potential	Non-explosive
Flammability potential	Not flammable
Colour/Form	white to gray-white, fine crystalline powder.
Overview	Talc finely powdered hydrous magnesium silicate mineral sometimes found in association with asbestos. After being mined, it is processed to remove impurities and powdered. Talc is a useful commercial product due to its fragrance retention, luster, purity, softness, and whiteness as well as its chemical inertness and oil and grease adsorption. Talc is a mineral composed of hydrated magnesium silicate. Talc refers to both mineral talc and industrial mineral products that are marketed under the name talc and contain proportions of mineral talc that range from about 35% to almost 100%. Industrial talc generally refers to products that contain abundant minerals other than talc; cosmetic talc now normally contains >98% talc but the content may have been lower in the past. Pharmaceutical talc contains >99% talc. Talcum powder is cosmetic-grade talc. This chemical has been identified by NICNAS to be of low concern to human health based on an initial screening approach and thus required no further assessment. Further assessment of the environmental risks from the use of this chemical is also not required.
Environmental Fate[5]	
Soil/Water/Air	Talc (Mg3H2(SiO3)4) is found abundantly in nature in soils and sediments. The material is an inorganic non-biodegradable substance, retaining its structure in the environment. At normal environmental pH's this material is stable. In addition it is unlikely through normal use patterns that exposure to natural sediments would occur. 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
Human Health Toxicity Summary [1,2,3]	
Chronic Repeated Dose Toxicity	Oral repeated dose toxicity: For a period of 101 days for male and female rats, the NOAEL of Talc in a feeding study was 100 mg/kg/day. No adverse effects were seen on general toxicity endpoints. One of the animals treated with talc showed a leiomyosarcoma of the stomach. Sarcomas, which were however not associated with the talc treatment, were found in the uterus of two animals. No chronic pathological effect was associated with oral administration of Italian talc (92% pure; 100 mg per day on 101 days over 5 months) to rats. Inhalation repeated dose toxicity: F344 rats and B6C3F1 mice were exposed to talc by inhalation for 20 days. The concentrations were 0, 2, 6, and 18 mg/m^3. The animals were exposed for 6 hours

	a day and 5 days per week. Lung burdens in rats increased from 70 µg talc/g lung in the 2 mg/m^3 group to 720 µg talc/g lung in the 18 mg/m^3 group. The histopathological examinations after 20 days of exposure did not show any exposure-induced lesions in the highest exposure group so that the specimens of the lower exposure groups were not examined. Dermal repeated dose toxicity: No studies were located regarding long term exposure local effects in animals after dermal exposure to talc.
Carcinogenicity	Talc-based body powder, when used perineally, is classified by IARC as group 2B as possibly carcinogenic to humans. However, talc for general use not containing asbestos or asbestiform fibres is classified as group 3 as not classifiable to its carcinogenicity to humans. Talc containing asbestiform fibres is classified by IARC as group 1 for carcinogenic to humans. Talc alone failed to induce respiratory tumors, granulomas or mesothelial proliferation in a hamster study but produced tumours of the larynx, trachea and lungs when tested in association with benzo(a)pyrene. In a rat study of aerosol talc there was some evidence of carcinogenic activity of talc in male F344/N rats and clear evidence of carcinogenic activity in female F344/N rats. No evidence of carcinogenicity was evident in intraperitoneal or inhalation studies in hamsters. Male and female Wistar rats were given in their diet 0 or 50 mg/kg of commercial talc [characteristics unspecified] for the life of the animals (average survival was 702 and 649 days, respectively). There was no significant difference in the talc-fed animals compared with control animals (Gibel *et al.*, 1976). In humans and experimental animals, the effects of talc are dependent on the route of exposure, and the dose and properties of the talc. Talc pneumoconiosis was somewhat more prevalent and severe among miners exposed to talc containing asbestiform minerals and/or asbestos than among those exposed to talc without such contaminants. However, the role of quartz and asbestos in the observed pneumoconiosis could not be ruled out. Among drug users, intravenous injection of talc present as a filler in the drugs resulted in microembolization in a variety of organs and alterations in pulmonary function. In animal studies, talc has been shown to cause granulomas and mild inflammation when inhaled. Observations of the effects that occurred in the lungs of rats exposed by inhalation to talc suggested that the operative mechanisms may be similar to those identified for carbon black, and talc is known to cause the release of cytokines, chemokines and growth factors from pleural mesothelial cells. IARC: There is *inadequate evidence* in humans for the carcinogenicity of inhaled talc not containing asbestos or asbestiform fibres. There is *limited evidence* in experimental animals for the carcinogenicity of talc not containing asbestos or asbestiform fibres. Inhaled talc not containing asbestos or asbestiform fibres is *not classifiable as to its carcinogenicity (Group 3)*.
Mutagenicity/ Genotoxicity	Talc was not mutagenic in host-mediated assays in mice. It did not produce chromosomal aberrations or dominant lethal mutations in rats. The IARC (1987) review of talc included unpublished results from a 1974 study conducted by Litton Bionetics that showed no mutagenic activity for talc *in vitro* or *in vivo.* Talc did not induce mutations in *Salmonella typhimurium* strains TA1530 or HisG46, or in the yeast, *Saccharomyces cerevisiae.* No chromosomal aberrations were observed in human fibroblasts treated with talc *in vitro. In vivo* tests conducted in rats gave negative results for induction of chromosomal aberrations in bone marrow cells and dominant lethal mutations in germinal cells.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	No teratological effects were observed in hamsters, rats, mice, or rabbits after oral administration of 900-1600 mg/kg. No teratologic effects were observed in hamsters, rats, mice, or rabbits after oral administration of talc. The doses used were 1,600 mg/kg for rats and mice on days *6* through 15 of gestation; 1,200 mg/kg for hamsters on day 6 through 10 of gestation; and 900 mg/kg for rabbits on days 6 through 18 of gestation.
Acute Toxicity	Acute inhalation exposure to talc causes symptoms such as cough, dyspnea, sneezing, vomiting, and cyanosis. Other inhalation exposure symptoms include diffuse pleural thickening and fibrous adhesions of pleural surfaces. Respiratory distress syndrome has been reported in children after massive accidental inhalation of talcum powder. Animal (rat, dog, rabbit) studies showed internal accumulation of talc after short- and long-term inhalation exposure as well as numerous lung afflictions such as fibrosis and inflammation.
Irritation	In monkey eyes, talc in the anterior chamber has induced persistent glaucoma. Talc can induce severe granulomatous reactions when introduced into wounds. It

	has induced granulomas in and about the human eye when as a dusting powder for surgeons' gloves.
Sensitisation	Talc particles are smaller than 1 um and these particles are respirable and produce an intense inflammatory response characterized by cough, rhinitis, dyspnea, and vomiting.
Health Effects Summary	This chemical has been identified by NICNAS to be of low concern to human health, and it is listed by the US Food and Drug Administration (FDA) as a Generally Recognised as Safe (GRAS) substance.
Key Study/Critical Effect for Screening Criteria	There are no adequate studies for which to derive am oral reference dose. Talc is poorly absorbed from the gastrointestinal tract, if at all, and the limited data available by the oral route indicate that talc is essentially non-toxic by the oral route of exposure.
Ecological Toxicity [2,3,4]	
Aquatic Toxicity	No data were found. Talc is expected to have low toxicity to the environmental based on its ubiquity in the environment, its low bioavailability, and its widespread use in consumer products (Zazenski et al. 1995). This chemical poses no unreasonable risk to the environment based on Tier I assessment under the NICNAS IMAP assessment framework. It is an inorganic substance with low toxicity and/or low bioavailability. It is of low concern to the environment.
Determination of PNEC aquatic	PNEC values for talc cannot be calculated.
Current Regulatory Controls	
Australian Hazard Classification	No data available
Australian Occupational Exposure Standards	TWA: 2.5 mg/m^3
International Occupational Exposure Standards	NIOSH: TWA 2 mg/m^3
Australian Food Standards	No data available
Australian Drinking Water Guidelines	No data available
Aquatic Toxicity Guidelines	No data available
PBT Assessment[4]	
P/vP Criteria fulfilled?	No. Methanol is expected to be readily biodegradable.
B/vB criteria fulfilled?	No. The Log Kow for methanol is -0.77. Thus, methanol does not meet the screening criteria for bioaccumulation.
T criteria fulfilled?	No. The EC50s from the acute aquatic toxicity data on methanol are >1 mg/L, hence does not meet the screening criteria for toxicity.
Overall conclusion	Not PBT

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Toxicity Summary - Formic acid

Chemical and Physical Properties[1,2,3]	
CAS number	64-18-6
Molecular formula	CH2O2
Molecular weight	46.03 g/mol
Solubility in water	Miscible in water
Density	1.22 at 20 °C
Melting point	4°C
Boiling point	100.2 °C
Vapour pressure	42.7 hPa at 20 °C
Henrys law constant	0.014 $Pa.m^3/mol$ at 20 °C
Explosive potential	Non-explosive
Flammability potential	Flammable (100%)
Colour/Form	Colourless fuming liquid with a pungent, penetrating odour
Overview	Formic Acid occurs naturally in animals, plants and foods. It is also added intentionally to some foods as a flavour adjunct.
Environmental Fate[2,3]	
Soil/Water/Air	Formic acid is hydrolytically stable (BASF AG, 2002). In the atmosphere, Formic Acid will be photodegraded by reactions with OH radicals with a half-life of 36 days. Formic Acid will not undergo hydrolysis at pH 4, 7, or 9.
Human Health Toxicity Summary [1,2,3]	
Chronic Repeated Dose Toxicity	When the chemical was administered to rats in the diet or drinking water (0.5 to 1%) the body weight gain and size of most organs were reduced (HSDB, 2013). Another study also in rats receiving up to 360 mg/kg of the chemical in drinking water for two to 27 weeks showed only a reduced feed intake and corresponding body weight gain (HSDB, 2013). The chemical was tested for repeated inhalation toxicity in 13 weeks studies in both rats and mice (OECD, 2008; US EPA, 2001). The effects seen were primarily limited to irritant effects of the respiratory tract although increased liver weights and decreased lung weights were also observed. The NOAEC in rats was 64 ppm based on the irritant effects seen at higher concentrations.
Carcinogenicity	There are no carcinogenicity studies available on the chemical. However, in two carcinogenicity studies with the analogue potassium hydrogen diformate (CAS number 20642-05-1) no evidence of increased carcinogenicity was seen (OECD, 2008).
Mutagenicity/ Genotoxicity	The chemical was not genotoxic in reverse mutation assays both with and without metabolic activation, although a test from 1951 which did not follow current protocols produced slightly positive results (US EPA, 2001). The chemical produced ambiguous results for chromosome aberrations in Chinese hamster ovary cells at pH levels that were only slightly above being cytotoxic. At higher pH levels the chemical did not produce chromosome aberrations (US EPA, 2001). The chemical was negative in two sister chromatid exchange assays and in a SOS chromotest (US EPA, 2001). An in vivo sex-linked recessive lethal test in Drosophila melanogaster with the chemical administered as a 0.1% vapour or in the diet resulted in mutations that were statistically significant, although when buffered in the feeding study to a pH of 7.5 there was no increase in mutation (OECD, 2008). As the chemical only produced mutations at low pH levels where the effects are likely to be due to the acidic nature of the chemical rather any underlying genotoxicity, the chemical is not considered to be genotoxic.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	Sodium formate was tested in a rat 2-generation study according to OECD test guideline No. 416 guideline. There was no effect on parental animals, reproduction parameters, or progeny at any dose level including 1000 mg/kg bw/day, the

	highest tested dose. This value was used to calculate the NOAEL for formic acid. 1000 mg sodium formate would compare to 676 mg formic acid, the NOAEL values calculated for formic acid are therefore 676 mg formic acid/kg bw/day. There were no signs that formic acid is a reproductive toxicant via the inhalative route. Developmental studies with the analogues potassium hydrogen diformate (CAS number 20642-05-1) and sodium formate (CAS number 141-53-7) in rats, rabbits and pigs showed no effects on the developing foetuses with NOAEL values of 1000 mg/kg bw/d (OECD, 2008).
Acute Toxicity	The chemical was reported to have moderate acute toxicity in animal tests following oral exposure. The lowest reported median lethal dose (LD50) in rats is 730 mg/kg bw. Observed sub-lethal effects included bloody nose and blood in urine. Histopathological changes in the stomach, liver and kidney were observed (OECD, 2008; EPA, 2001). The chemical was reported to have moderate acute toxicity in animal tests following inhalation exposure. The median lethal concentration (LC50) in rats is 7.4 mg/L (vapour). Observed sub-lethal effects included corrosion of the nose and eye, corneal opacity and noisy breathing. Symptoms persisted until termination at day 14.
Irritation	The chemical is classified as hazardous with the risk phrase 'Causes severe burns' (C; R35) in HSIS (Safe Work Australia). The data available (pH < 2 (pKa = 3.75 at 20 °C)) support this classification (OECD, 2008). There are no skin and eye irritation studies available on the chemical (OECD, 2008).
Sensitisation	The chemical was not shown to be a skin sensitiser in a Buehler study (OECD, 2008). Sensitisation in humans has been reported when the patient had been previously sensitised to formaldehyde (HSDB, 2012).
Health Effects Summary	The main critical effect to human health is corrosion. The chemical also possesses hazardous properties such as acute toxicity following inhalation or oral exposure.
Key Study/Critical Effect for Screening Criteria	The chemical was reported to have moderate acute toxicity in animal tests following oral exposure. The lowest reported median lethal dose (LD50) in rats is 730 mg/kg bw. Observed sub-lethal effects included bloody nose and blood in urine. Histopathological changes in the stomach, liver and kidney were observed (OECD, 2008; EPA, 2001). The chemical was reported to have moderate acute toxicity in animal tests following inhalation exposure. The median lethal concentration (LC50) in rats is 7.4 mg/L (vapour). Observed sub-lethal effects included corrosion of the nose and eye, corneal opacity and noisy breathing. Symptoms persisted until termination at day 14.
Ecological Toxicity[2,3]	
Aquatic Toxicity	Tests using Formic Acid show EC/LC50 values between 1 and 100 mg/L. These results appear to be due to acidity as demonstrated in the test with *Leuciscus idus*, where a neutralized test solution of 100 mg/L produced no mortality. In a chronic toxicity test following OECD TG 211, Daphnia magna was given Formic Acid under neutralized conditions; the 21-d NOEC for effects on reproduction was 100 mg/L.
Determination of PNEC aquatic	A PNECaqua = 2 mg/L can be calculated based on the chronic toxicity value (21 day NOEC = 100 mg/l) for aquatic invertebrates (Daphnia) with the assessment factor of 50.
Current Regulatory Controls[1]	
Australian Hazard Classification	The chemical is classified as hazardous with the following risk phrases for human health in the Hazardous Substances Information System (HSIS) (Safe Work Australia): C; R35.
Australian Occupational Exposure Standards	The chemical has an exposure standard of 9.4 mg/m^3 (5 ppm) time weighted average (TWA) and 19 mg/m^3 (10 ppm) short term exposure limit (STEL).
International Occupational Exposure Standards	The following exposure standards are identified (Galleria Chemica): An exposure limit (TWA) of 9 – 9.4 mg/m^3 (5 ppm) and STEL of 19 mg/m^3 (10 ppm) in different countries such as Denmark, France, Germany, Japan, UK and USA.
Australian Food Standards	No data available.

Australian Drinking Water Guidelines	No data available.
Aquatic Toxicity Guidelines	No data available.
PBT Assessment	
P/vP Criteria fulfilled?	No. In two Modified OECD Screening Tests following OECD TG 301E, Formic Acid was degraded to 99 and 98 % related to DOC after 11 and 14 days, respectively. Thus, formic acid is readily biodegradable and does not meet the screening criteria for persistence.
B/vB criteria fulfilled?	No. The low log Kow values of < 0 and the calculated BCF values of 3.2 show low potential for bioaccumulation.
T criteria fulfilled?	No. The NOECs from the chronic aquatic toxicity data on Formic Acid are >0.01 mg/L, hence does not meet the screening criteria for toxicity.
Overall conclusion	Not PBT

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Toxicity Summary - Cinnamaldehyde

Chemical and Physical Properties [1,2,3,4]	
CAS number	104-55-2
Molecular formula	C9H8O
Molecular weight	132.16
Solubility in water	2.11 g/L at 22 °C
Melting point	-18 °C
Boiling point	250°C
Vapour pressure	3.85 Pa at 25 °C
Henrys law constant	0.162 Pa.m^3.mol-1 at 25 °C
Explosive potential	Non-explosive
Flammability potential	Non-flammable
Colour/Form	Yellowish oily liquid with strong odour of cinnamon
Overview	Cinnamaldehyde is a plant natural product that is present in some essential oils extracted from plants. For large scale applications such as in the flavouring and fragrance industries, this chemical is synthesised.
Environmental Fate [1,3]	
Soil/Water/Air	Cinnamaldehyde is expected to remain in soil, or partition to water and sediment, when released as a result of industrial uses. It is not expected to be persistent in the environment and is expected to undergo rapid and ultimate biodegradation in water. Cinnamaldehyde is not expected to bioaccumulate in aquatic organisms. No evidence has been identified to indicate that Cinnamaldehyde biomagnify through the aquatic food chain. The atmospheric oxidation half-life of cinnamaldehyde was estimated using the level III multimedia model. It was estimated that the substance is not persistent in air medium as the half-life period of cinnamaldehyde in air is only 0.31 days. This indicates that cinnamaldehyde is rapidly phototransformed in air. The Hydrolysis rate constant of Cinnamaldehyde is estimated to be 3.36 x 10-17 cm^3/molecule-sec. at half-life of 3.411 days indicating that the substance is slowly hydrolysable.
Human Health Toxicity Summary [2,4]	
Chronic Repeated Dose Toxicity	Cinnamaldehyde is 'generally regarded as safe' for use as a flavour ingredient by the US Food and Drug Administration (US FDA, 2015), reflecting the low level of concern regarding its potential for long-term toxicity via the oral route. Considering the no observed adverse effect levels (NOAELs) of 68–200 mg/kg bw/day, based on 17-week to 2-year rat studies (read across), and no toxicologically significant treatment-related effects reported in various studies, repeated oral exposure to the chemical is not considered to cause serious damage to health. Based on the limited data available, the chemical is not considered to cause serious damage to health by repeated dermal exposure.
Carcinogenicity	Based on the limited data available for cinnamaldehyde and trans-cinnamaldehyde (CAS No. 14371-10-9), the chemical is not expected to have carcinogenic potential. In a two-year carcinogenicity study, groups of F344/N rats and B6C3F1 mice (50 animals/sex/dose) were fed microencapsulated trans-cinnamaldehyde (CAS No. 14371-10-9) by daily gavage at doses of 0, 1000, 2100 or 4100 ppm (equivalent to 0, 50, 100 or 200 mg/kg bw/day). Increased incidences of preputial and prostate gland adenomas and mononuclear cell leukaemia were considered to be within the historical range in controls, or likely to represent biological variations unrelated to exposure to the chemical. No other treatment-related neoplasms or non-neoplastic lesions were reported in either species (Adams et al., 2004; NTP, 2004; REACH; US HPVIS, 2009).
Mutagenicity/ Genotoxicity	The chemical cinnamaldehyde contains an a,b-unsaturated aldehyde group, a common structural alert for genotoxicity due to the ability of the chemical to form DNA adducts. However, based on the available data, the chemical is not

	considered to be genotoxic. The chemical cinnamaldehyde and the isomer trans-cinnamaldehyde (CAS No. 14371-10-9) were negative for point mutations in almost all strains of Salmonella typhimurium in the Ames test. A positive result was found only with TA100 strain, and in only two out of eleven tests. Evidence of genotoxic activity was also observed in isolated mammalian cells. However, these results were weakly positive and observed at cytotoxic concentrations. A sex-linked recessive lethal test in Drosophila melanogaster demonstrated that systemically-available chemical (administered via injection) could enter germ cells and induce mutations; however, oral dosing did not produce the same effect. Importantly, the reported activity in in vitro and insect studies did not translate into significant genotoxic activity in mammalian systems in vivo.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	The chemical is not expected to have the potential for reproductive or developmental toxicity. Any developmental effects were only observed secondary to maternal toxicity. In a two-generation study in rats (strains not reported), cinnamaldehyde (absolute dose 2 mg—route not specified) was dosed every two days for 223 and 210 days and did not have any effects on body weight gain, reproductive ability, development or viability of offspring (NTP, 2004). Cinnamaldehyde in olive oil was administered to female SD rats via oral gavage at doses of 0, 5, 25 or 250 mg/kg bw/day on gestation days (GD) 7–17. Treatment-related, increased incidence of defective cranial ossification in all dose groups was observed. Renal abnormalities including dilated pelvis and reduced papilla and dilated ureters were observed at low and mid doses, but not at high dose. Offspring at ≥25 mg/kg bw/day had significantly increased instances of reduced ossification of the tympanic bulla. An increase in the incidence of abnormal sternebrae was also reported in the 25 mg/kg bw/day group. However, these effects were not found to be dose-related and may be attributed to a decrease in maternal weight gain that was noted in the mid- and high-dose groups. A LOAEL of 5 mg/kg bw/day for developmental toxicity was reported based on the reduced cranial ossification and kidney variations. A LOAEL of 25 mg/kg bw/day was reported for maternal toxicity based on the reduced weight gain observed in the dams (Adams et al., 2004; NTP, 2004; US HPVIS, 2009; HSDB; REACH). No signs of toxicity were reported in the dams or in the offspring of CD-1 mice after exposure to 1200 mg/kg bw/day during GD 6–13 (cinnamaldehyde) or GD 7–14 (trans-cinnamaldehyde) (NTP, 2004; US HPVIS, 2009; REACH).
Acute Toxicity	Cinnamaldehyde has low acute oral toxicity based on animal studies. The median lethal dose (LD50) in rats is >2000 mg/kg bw. Cinnamaldehyde has moderate acute dermal toxicity based on animal studies, warranting hazard classification. The dermal LD50 in rabbits was in the range of 620–1260 mg/kg bw (Bickers et al., 2005; Cocchiara et al., 2005; FFHBVC, 2005; and US HPVIS, 2009). Albino rabbits (2 animals/dose) were administered a single dose of cinnamaldehyde (0, 0.25, 0.50, 1.0, 2.0 or 4.0 mL/kg bw—equivalent to 0, 263, 525, 1050, 2100 or 4200 mg/kg bw) by application to intact and abraded skin. All animals in the 1.0 mL/kg and higher dose groups died after treatment. The LD50 was reported to be 620 mg/kg bw (Cocchiara et al., 2005; FFHPVC, 2005; US HPVIS, 2009; REACH).
Irritation	Respiratory irritation was assessed in CF-1 female mice by recording their respiratory rate following exposure to nebulised cinnamaldehyde for 1 minute, either through nose-only breathing or via a tracheal cannula. Marked respiratory depression with nose-only inhalation was observed. The ED25 (dose providing a 25 % reduction in respiratory rate) was calculated to be 241 µg/L. No significant effects were observed when inhalation was through the tracheal cannula (Cocchiara et al., 2005). Cinnamaldehyde produced severe irritation in rabbits when applied undiluted, mild irritation in mice and guinea pigs at concentrations of 3–5 %, and was non-irritating to rabbits at 1 % (Bickers et al., 2005). The US EPA considers cinnamaldehyde a strong skin irritant in guinea pigs (no study details provided) (US HPVIS, 2009). Several international agencies have concluded that cinnamaldehyde is an eye irritant (US HPVIS, 2009; REACH), and a number of notifications to the Classification and Labelling Inventory by industry in the European Union have indicated the chemical as irritating to the eyes (ECHA C&L).
Sensitisation	The chemical was considered to be a moderate to strong skin sensitiser based on the positive results in several local lymph node assays (LLNA). The EC3 value (concentration required to provoke a 3-fold increase in lymph node cell

	proliferative activity compared with controls) was reported to be as low as 0.2 % (SCCS, 2012).
Health Effects Summary	Cinnamaldehyde is a well-recognised and frequently reported consumer contact allergen (SCCNFP, 1999; RIVM, 2009; SCCS, 2012; IFRA, 2013). It is one of eight components of the diagnostic test, the fragrance mix, used by dermatologists to determine if a patient has allergies to common chemicals used in fragrances. It is an established contact allergen in humans according to the Scientific Committee on Consumer Safety (2012), and accounts for 5–36 % of the reactions to the fragrance mix (SCCNFP, 1999). A number of human repeat insult patch tests (HRIPTs) have been undertaken to determine the skin sensitisation potential of cinnamaldehyde in healthy volunteers, as well as groups of subjects suspected of skin allergies to fragrances (SCCNFP, 1999; NTP, 2004; Cocchiara et al., 2005). Although fewer cases of sensitisation were found when the concentration of the chemical was less than 1 %, positive allergic responses have been reported in cases where the administered concentration of cinnamaldehyde was as low as 0.2 % (Cocchiara et al., 2005). Skin irritation effects were generally predominant at concentrations above 3 % cinnamaldehyde, and often impeded the interpretation of results from the patch testing (SCCNFP, 1999; NTP, 2004). Many cases of skin sensitisation have occurred following occupational and consumer exposure to the chemical. Workers in spice manufacturing plants, hairdressing salons and bakeries have reported cases of contact dermatitis that were traced back to cinnamaldehyde. In addition, exposure of consumers to toothpaste, cosmetics and perfumes containing the chemical as a fragrance ingredient have resulted in a number of case studies identifying cinnamaldehyde as an agent responsible for the allergic reactions (see SCCNFP, 1999; NTP, 2004; Cocchiara et al., 2005 for review).
Key Study/Critical Effect for Screening Criteria	The critical health effect for risk characterisation is skin sensitisation. Other observed health effects include systemic acute effects (acute toxicity from dermal exposure) and local effects (eye/skin/respiratory irritation). The NOAEL of 200 mg/kg bw/day, based on the 2-year rat studies has been adopted in this risk assessment and used to calculate the oral RfD. Uncertainty factors: 10 (interspecies variability); 10 (intraspecies variability) Oral RfD = 200/100 = 2 mg/kg/dayDrinking water guideline value = 7.8 mg/L
Ecological Toxicity [1]	
Aquatic Toxicity	The following data are measured acute toxicity values for cinnamaldehyde: Danio rerio (Zebrafish) EC Directive 92/69/EEC C.1 Acute Toxicity for Fish: 96 h LC50 = 3.1 mg/L; Daphnia magna (Water flea) OECD TG 202: 48 h EC50 = 3.86 mg/L; Pseudokirchneriella subcapitata (Green algae) OECD TG 201: 72 h EC50 = 4.07 mg/L. In the chronic toxicity study, the 72 h NOEC value of 2.0 mg/L was reported for Pseudokirchneriella subcapitata (Green algae) OECD TG 201.
Determination of PNEC aquatic	A PNECaqua = 0.2 mg/L can be calculated based on the chronic toxicity value (72 h NOEC = 2 mg/L) for green algae with the assessment factor of 10.
Current Regulatory Controls[4]	
Australian Hazard Classification	The chemical is not listed in the Hazardous Substances Information System (HSIS) (Safe Work Australia).
Australian Occupational Exposure Standards	No specific exposure standards are available for the chemical.
International Occupational Exposure Standards	The US Temporary Emergency Exposure Limits (TEELs) for cinnamaldehyde are 14, 150 and 670 mg/m^3 (Galleria Chemica).
Australian Food Standards	No data available.
Australian Drinking Water Guidelines	No data available.

Aquatic Toxicity Guidelines	No data available.
PBT Assessment	
P/vP Criteria fulfilled?	Not Persistent. Based on the results of the ready biodegradability studies, cinnamaldehyde is categorised as Not Persistent.
B/vB criteria fulfilled?	Not Bioaccumulative. Based on low log K values and/or expected natural metabolism and regulation of internal concentrations, the chemical is categorised as Not Bioaccumulative
T criteria fulfilled?	Not Toxic. Based on measured acute toxicity endpoints of greater than 1 mg/L cinnamaldehyde is categorised as Not Toxic.
Overall conclusion	Not PBT

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Toxicity Summary - Ethylene glycol

Chemical and Physical Properties[1,2,3,4,5]	
CAS number	107-21-1
Molecular formula	C2H6O2
Molecular weight	62.07 g/mol
Solubility in water	Miscible with water
Melting point	-13ºC
Boiling point	197ºC
Vapour pressure	0.0104 kPa at 25°C
Henrys law constant	6.00 x 10^{-8} atm-cu m/mol at 25 deg C
Explosive potential	Not explosive
Flammability potential	Lower flammable limit of 3.2% by volume; Flashpoint of 232 deg F (111 deg C). Not combustible.
Colour/Form	Clear, colourless, odourless liquid
Overview	Ethylene glycol is a clear, colourless, syrupy liquid with a sweet taste but no odour. It has low volatility. It is miscible with water and some other solvents, slightly soluble in ether, but practically insoluble in benzene, chlorinated hydrocarbons, petroleum ethers, and oils. As a small molecular weight alcohol, ethylene glycol readily passes through biological membranes and will be effectively absorbed from the gastrointestinal tract and via inhalation exposure. It is rapidly distributed in body water. The chemical has numerous domestic and commercial uses, and is found in cleaning products, cosmetics, hydraulic brake fluids, anti-freeze agents and corrosion inhibitors. Ethylene glycol has been assessed by NICNAS to be of low environmental concern when used in coal seam gas extraction.
Environmental Fate[1,3,5]	
Soil/Water/Air	Ethylene glycol released to the atmosphere will be degraded by reaction with hydroxyl radicals; the half-life for the compound in this reaction has been estimated at between 0.3 and 3.5 days. No hydrolysis of ethylene glycol is expected in surface waters. The compound has little or no capacity to bind to particulates and will be mobile in soil. The low octanol/water partition coefficient and measured bioconcentration factors indicate low capacity for bioaccumulation Ethylene glycol is readily biodegradable in standard tests using sewage sludge. Rapid degradation has been reported in surface waters (less in salt water than in fresh water), groundwater, and soil.
Human Health Toxicity Summary[2,3,4]	
Chronic Repeated Dose Toxicity	The critical study for determining the effects of repeated exposures to the chemical is the well-conducted study (Klimisch = 1) by Wilson et al. (2005), also cited as Corley et al. (2008) as this study is of a longer duration and the effects in the kidneys were studied in more detail. The severity of nephropathy in the kidneys was scored on a scale of 0 (no crystal nephropathy) to 5 (end-stage nephropathy indicative of impending renal failure) to determine the renal effects of ethylene glycol. At 400 mg/kg bw/day severity ranged from 3 (moderate) to 5 and at 300 mg/kg bw/day, severity ranged from 1 (minimal) to 4 (marked). Treatment-related nephropathy was not seen at the two lowest doses. The concentrations of glycolic acid and oxalate were increased at 300 and 400 mg/kg bw/day indicating that the accumulation of calcium oxalate in the kidneys correlated with renal toxicity (ATSDR 2010). Repeated oral exposure to ethylene glycol was consistently associated with adverse effects on the kidney such as crystal nephropathy. Fatty degeneration and

	hyaline degeneration of the liver were not seen consistently at the doses at which renal effects were observed.
Carcinogenicity	Histopathological investigations showed no evidence of carcinogenicity in Sprague-Dawley rats administered ≤3000 mg/kg bw/day in the diet for two years (Blood 1965), F344 rats administered 1000 mg/kg bw/day in the diet for one year (DePass et al. 1986a; Woodside 1982), B6C3F1 mice administered ≤12 000 mg/kg bw/day in the diet for two years (Melnick 1984), or CD-1 mice administered ≤1000 mg/kg bw/day in the diet for two years (DePass et al. 1986a; Woodside 1982). Based on the available data, ethylene glycol is not considered to be carcinogenic.
Mutagenicity/ Genotoxicity	In vivo studies showed negative results for dominant lethal mutations in F344 rats after administration of up to 1000 mg/kg bw/day ethylene glycol in a 155-day multi-generational study (DePass et al. 1986b). Negative chromosomal aberration results were observed in Swiss mice exposed to 638 mg/kg bw/day for two days (WHO 2002). Ethylene glycol yielded negative results in an Ames assay for reverse mutation for several Salmonella typhimurium strains (Clark et al. 1979; Kubo et al. 2002; McCann et al. 1975; Pfieffer and Dunkelberg 1980; Zeiger et al. 1987); gene mutation in the yeast Schizosaccharomyces pombe (Abbondandolo et al. 1980); and aneuploidy induction in the fungus Neurospora crassa (Griffiths 1979, 1981). The chemical did not induce growth inhibition in Escherichia coli repair-deficient strains (McCarroll et al. 1981) and did not induce gene mutations in L5178Y mouse lymphoma cells (McGregor et al. 1991) or deoxyribonucleic acid (DNA) strand breaks in primary rat hepatocytes (Storer et al. 1996). Based on the available studies, ethylene glycol is not considered to be genotoxic.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	The available data from rat studies suggest that developmental effects were only observed secondary to maternal toxicity, so the chemical does not show specific developmental toxicity. The chemical is not toxic to reproduction. Having reviewed the available data the Centre for the Evaluation of Risks to Human Reproduction (CERHR) expert panel concluded that there are sufficient data to conclude that the chemical is not toxic to reproduction in rats orally exposed to 1000 mg/kg bw/day in diet (NTP, 2004). A study in mice gave negative results at doses up to 2826 mg/kg bw/day via drinking water. The expert panel also concluded that exposure of CD-1 mice to the chemical by the dermal route for 6 hours/d on gestation days (GD) 6-15 resulted in no evidence of developmental toxicity up to a dose of 3549 mg/kg bw/d. Developmental toxicity was also not observed in rabbits exposed orally via gavage on GD 6-19 to doses as high as 2000 mg/kg bw/d. Severe maternal toxicity was observed at the high dose with maternal deaths as well as oxalate crystals in the kidney. Data suggested that oral exposure to high doses of the chemical (≥500 mg/kg bw/d in CD-1 mice and ≥1000 mg/kg bw/d in SD rats) on GD 6-15 causes developmental effects in mice and rats such as axial skeletal malformations, external malformations, reduced body weights and increased post-implantation loss (NTP, 2004). The CERHR expert panel concluded that developmental toxicity may not be attributed directly to the chemical but from the accumulation of glycolic acid, which is a metabolic breakdown product of ethylene glycol. The developmental effects are seen at doses that exceed saturation of glycolic acid metabolism. Observations from rat studies suggest that oral doses resulting in developmental toxicity (1000 mg/kg bw/d) are greater than those associated with maternal and renal toxicity at 500 mg/kg bw/d.
Acute Toxicity	Oral median lethal doses (LD50s) for ethylene glycol were 4000 to 10,020 mg/kg bw in rats, 6610 to 8200 mg/kg bw in guinea pigs, 5500 to 8350 mg/kg bw in mice, 5000 mg/kg bw in rabbits, and >8000 mg/kg bw in dogs (NTP-CERHR 2004; WHO 2002). The minimum lethal oral dose (LDmin) in rats was reported to be 3800 mg/kg bw (Clark et al. 1979). The toxicity demonstrated by ethylene glycol included central nervous system depression, metabolic acidosis, cardiopulmonary effects and renal toxicity (NTP-CERHR 2004). The studies show that ethylene glycol has low acute toxicity by the oral route in rodents, guinea pigs, rabbits and dogs. A dermal LD50 of 10 600 mg/kg bw was reported in rabbits (WHO 2002). No other details were provided of how this was determined. The study shows that ethylene glycol has low acute toxicity by the dermal route in rabbits.

	Lethal concentrations of >200 mg/m^3 were observed in rats and mice after a two-hour inhalation exposure to ethylene glycol (WHO 2002). No other details were provided for how this was determined. The study shows that ethylene glycol has low acute toxicity by the inhalation route in rabbits.
Irritation	Mild dermal irritation was induced in rabbits and guinea pigs (Clark et al. 1979; Guillot et al. 1982; Anderson et al. 1986). No dermal effects were observed in female CD-1 mice administered 3549 mg/kg bw/day ethylene glycol under occlusion for 6 hours/day on GD6-15 (Tyl 1988; Tyl et al.1995). The studies show that ethylene glycol is a mild skin irritant in animals. Minimal conjunctival irritation, without permanent corneal damage, was observed in rabbits following single ocular application of liquid or vapour ethylene glycol (McDonald et al. 1972; Clark et al. 1979; Guillot et al. 1982; Grant and Schuman 1993). The studies show that the chemical is a mild eye irritant in animals.
Sensitisation	No evidence of skin sensitisation was observed in a guinea pig maximisation test (Kuriharaet al. 1996). The chemical is not considered to be a skin sensitiser.
Health Effects Summary	Ethylene glycol demonstrates acute oral toxicity, is a mild skin and eye irritant and a respiratory irritant in humans. The chemical is not a skin sensitiser. Consistent adverse effects associated with repeated exposure to ethylene glycol in animals are the kidney effects, characterised by calcium oxalate crystal deposition and consequent renal lesions.
Key Study/Critical Effect for Screening Criteria	The key study chosen for the risk assessment is the 12-month dietary exposure study by Wilson et al. (2005) and Corley et al. (2008), where the NOAEL was determined to be 150 mg/kg bw/day based on renal toxicity. The oral RfD for ethylene glycol is thus based on the NOAEL of 150 mg/kg/day. Uncertainty factors: 10 (interspecies variability); 10 (intraspecies variability) Oral RfD = 150/100 = 1.5 mg/kg/dayDrinking water guideline value = 0.59 mg/L
Ecological Toxicity[3,5]	
Aquatic Toxicity	The aquatic toxicity of the 'ethylene glycol and higher glycols' (mono-, di-, tri-, tetra- and pentaethylene glycol) is evaluated as a category. Fish acute toxicity (measured as LC50 in mg/L) has been tested for all category members and ranges from 22800 for EG to greater than 50000 for pentaEG. Toxicity to Daphnia (measured as LC50 in mg/L) is greater than 20,000 for all category members except tetraEG (LC50=7800 mg/L) indicating low toxicity, but the toxicity was not as uniform as in fish. Toxicity evaluations in another invertebrate, brine shrimp (Artemia salina) were imprecise, but appear to be more consistent than the measured Daphnia toxicity values (no toxicity observed at the highest tested dose, 20g/l for EG, 10 g/l for DEG, TEG and tetraEG). Algal toxicity has been tested for EG, DEG, TEG, and PentaEG, and no toxicity was found at concentrations less than or equal to 100 mg/L. As a worst case assumption the limit test concentration of 100 mg/L was used as NOEC value for the PNEC derivation.
Determination of PNEC aquatic	PNECaquatic: An assessment factor of 10 has been applied to the lowest reported effect concentration of 100 mg/L. The PNECaquatic is determined to be 10 mg/L.
Current Regulatory Controls[4]	
Australian Hazard Classification	Ethylene glycol is classified as hazardous for human health in the Hazardous Substances Information System (HSIS) (Safe Work Australia 2013) with the following risk phrases: • Xn (Harmful); R22 (Harmful if swallowed) Mixtures containing ethylene glycol are classified as hazardous with the following risk phrase based on the concentration (Conc) of the chemical in the mixtures. The risk phrase for this chemical is: Conc ≥25%: Xn (Harmful); R22 (Harmful if swallowed)
Australian Occupational Exposure Standards	Time Weighted Average (TWA): • 52 mg/m^3 (20 ppm) (vapour) • 10 mg/m^3 (particulate) Short-Term Exposure Limit (STEL): 104 mg/m^3 (40 ppm)

International Occupational Exposure Standards	The following exposure standards were identified (Galleria Chemica 2013): TWA: • 52 mg/m^3 (20 ppm) [Belgium, Hungary, UK, Finland] • 26 mg/m^3 (10 ppm) [Denmark, Iceland, Sweden] • 25 to 50 mg/m^3 (63 to 125 ppm) [Mexico, Norway] • 5 mg/m^3 [Russia] STEL: • 20 to 40 mg/m^3 (50 to 104 ppm) [Belgium, Hungary, UK, Finland, Peru, Sweden] 10 mg/m^3 [Russia]
Australian Food Standards	No Australian food standards relating to ethylene glycol were identified.
Australian Drinking Water Guidelines	No aesthetic or health-related guidance values were identified for ethylene glycol in the Australian Drinking Water Guidelines (National Health and Medical Research Council (NHMRC) 2011).
Aquatic Toxicity Guidelines	No data found.
PBT Assessment [1,3,5]	
P/vP Criteria fulfilled?	Ethylene glycol is readily biodegradable both aerobically and anaerobically and as such not persistent in the environment.
B/vB criteria fulfilled?	Based on the measured log Kow of -1.36 and a measured BCF of 10, Ethylene glycol is not bioaccumulative.
T criteria fulfilled?	The acute aquatic toxicity of Ethylene glycol is > 0.01 mg/L. Hence the substance does not fulfill the screening criteria for toxic (T)
Overall conclusion	Not PBT

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4. Department of the Environment and Energy 2017, National assessment of chemicals associated with coal seam gas extraction in Australia, prepared by the National Industrial Chemicals Notification and Assessment Scheme
5. ECHA REACH, Ethane-1,2-diol, Retrieved 2024: https://echa.europa.eu/.

Toxicity Summary - Crystalline silica

Chemical and Physical Properties [1,3]	
CAS number	14808-60-7
Molecular formula	SiO_2
Molecular weight	60.09 g/mol
Solubility in water	Insoluble/negligible
Melting point	1610°C
Boiling point	2230°C
Vapour pressure	Not available
Henrys law constant	Not available
Explosive potential	Not explosive
Flammability potential	Not flammable
Colour/Form	Transparent crystals
Overview	Silica is an off-white granule that occurs naturally in various crystalline and amorphous or other non-crystalline forms. Crystalline silica is characterized by silicon dioxide (SiO2) 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. Uncalcined diatomaceous earth typically contains around 1%crystalline silica. When diatomaceous earth is subjected to pressure or is processed ("calcined") at temperatures above 1000°C some of the amorphous silica is converted to crystalline silica in the form of cristobalite. Calcined diatomaceous earth can contain anywhere from 1% to 75% cristobalite.
Environmental Fate [1,2]	
Soil/Water/Air	Crystalline Silica consists of diatomaceous earth, a naturally occurring material. Its primary component, silica, is found in common materials like quartz, sand and agate. The materials are ubiquitous and unlikely to react chemically with any other substance in the environment.
Human Health Toxicity Summary [1,2,3]	
Chronic Repeated Dose Toxicity	A number of animal studies have found that cristobalite is more toxic to the lung than quartz, and more tumorigenic (e.g., King et al. 1953; Wagner et al. 1980). However, several other authors concluded that this is not the case (Bolsaitis and Wallace 1996; Guthrie and Heaney 1995). OSHA (2013) has examined evidence on the comparative toxicity of the silica polymorphs (quartz, cristobalite, and tridymite) and found no difference in toxicity effects between cristobalite and quartz. Furthermore, no difference in toxicity between cristobalite and quartz has been observed in epidemiologic studies (NIOSH 2002). There is no information on the repeat dose oral, inhalation or dermal effect of calcined silica. However, since calcined diatomaceous earth contains varying amounts of crystalline silica in the form of cristobalite, and may also contain small amounts of quartz and tridymite, it is expected that any long-term health hazards associated with diatomaceous earth would mainly be due to the effects of crystalline silica. In humans, the most prevalent effect identified from long term exposure in occupational settings is silicosis, a diffused nodular pulmonary fibrosis (US EPA 1996).
Carcinogenicity	IARC (2012) concluded that there is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica in the form of quartz or cristobalite from occupational sources. There is sufficient evidence in experimental animals for the carcinogenicity of quartz and cristobalite.

	The IARC has also concluded that inhaled crystalline silica in the form of cristobalite or quartz from occupational sources is carcinogenic to humans (Group 1) (IARC 2012).
Mutagenicity/ Genotoxicity	Conflicting results have been reported in genotoxicity studies with crystalline quartz or cristobalite, and a direct genotoxic effect for crystalline silica has not been confirmed or ruled out. Studies on genotoxicity of calcined diatomaceous silica are not available.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	No data available.
Acute Toxicity	No data available.
Irritation	No data available. Most acute toxicity studies for quartz or cristobalite were conducted using intratracheal instillation. 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 general, exposure to high concentrations of dust may cause coughing and mild, temporary irritation (CCOHS 2001).
Sensitisation	No data available. However, based on the structure and physico-chemical properties, the three forms of crystalline silica or the calcined diatomaceous silica are not expected to cause skin sensitisation.
Health Effects Summary	The substances are not skin or eye irritants but acute inhalation of dust may cause discomfort and stress as well as signs of local irritation to nasal, bronchiolar and ocular mucous membranes. Based on the evaluation of the epidemiological data it is concluded that inhalation exposure to crystalline silica results in lung cancer. This conclusion is also supported by animal studies in which inhalation and intratracheal exposure to crystalline silica resulted in lung tumours. The most common types of lung tumour observed in rats were lung adenocarcinomas.
Key Study/Critical Effect for Screening Criteria	Not applicable.
Ecological Toxicity [1,2,3]	
Aquatic Toxicity	Aquatic toxicity studies performed at saturation concentrations of synthetic amorphous silica showed no acute toxicity to fish, Daphnia, or algae, though some physical effects were observed with loading rates of greater than or equal to 10 g/L (OECD 2004). Any harmful effects to aquatic ecosystems are therefore not ecotoxicological in nature. No chronic toxicity data were identified.
Determination of PNEC aquatic	Not applicable.
Current Regulatory Controls [3]	
Australian Hazard Classification	Quartz and cristobalite are listed in the Hazardous Substances Information System (HSIS) (Safe Work Australia 2014a) as hazardous substances. Calcined silica is not listed in the HSIS.
Australian Occupational Exposure Standards	Time Weighted Average (TWA) occupational exposure standard of 0.1 mg/m³ for quartz and cristobalite are recommended in Australia (Safework Australia 2013). A Short-Term Exposure Limit (STEL) is not recommended for any of the compounds.
International Occupational Exposure Standards	TWA for quartz, cristobalite: Canada: 0.025 mg/m³ France: 0.05 mg/m^3 Japan: 0.03 mg/m³ Sweden: 0.05 mg/m^3 US (ACGIH): 0.025 mg/m^3 US (NIOSH): 0.05 mg/m^3 US (OSHA): 0.1 mg/m^3 US: 0.3, 0.9, 1.5, 500 mg/m^3 Temporary Emergency Exposure Limits (TEEL) (Diatomaceous silica, calcined)

Australian Food Standards	No data found.
Australian Drinking Water Guidelines	The Australian Drinking Water Guidelines state: 'To minimise an undesirable scale build up on surfaces, silica (SiO¬2) within drinking water should not exceed 80 mg/L' (National Health and Medical Research Council (NHMRC) 2001).
Aquatic Toxicity Guidelines	No data found.
PBT Assessment [3]	
P/vP Criteria fulfilled?	No. Not applicable, inorganic substance, ubiquitous in environment.
B/vB criteria fulfilled?	No. Not applicable, inorganic substance, ubiquitous in environment.
T criteria fulfilled?	No. Long term data not available (acute data >0.1 mg/L).
Overall conclusion	It is not currently possible to categorise the environmental hazards of metals and other inorganic chemicals according to standard persistence, bioaccumulation and toxicity (PBT) hazard criteria. These criteria were developed for organic chemicals and do not take into account the unique properties of inorganic substances and their behaviour in the environment (UNECE 2007; US EPA 2007). Further assessment of the environmental risks from the use of this chemical is not required as identified by DoEE

References

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2. OECD-SIDS Initial Targeted Assessment Profile on Quartz and Cristobalite, SIAM 32, 19-21 April 2011.
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Toxicity Summary - Partially hydrolysed polyacrylamide

Chemical and Physical Properties[1,2,3,4]	
CAS number	9003-05-8
Molecular formula	(C3H5NO)x
Molecular weight	1,000,000 to > 50,000,000 g/mol for polyacrylamide copolymers used as flocculants
Solubility in water	Water soluble
Melting point	No data available.
Boiling point	No data available.
Vapour pressure	No data available.
Henrys law constant	No data available.
Explosive potential	No data available.
Flammability potential	No data available.
Colour/Form	No data available.
Overview	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. Anionic polyacrylamide polymer can also be formed from the copolymerisation of acrylamide and acrylic acid. A Tier 1 Human Health and Environmental Assessment for this chemical has been conducted by NICNAS which concluded that it was low concern to human health and the environment and thus required no further assessment.
Environmental Fate [3]	
Soil/Water/Air	No studies on the environmental fate of anionic polyacrylamide are available. As a high-molecular weight, water-soluble polymer, it is not expected to biodegrade or bioaccumulate. The environmental fate of anionic polyacrylamide will be determined primarily by adsorption. 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.
Human Health Toxicity Summary [1,2,4]	
Chronic Repeated Dose Toxicity	No data available.
Carcinogenicity	No data available.
Mutagenicity/ Genotoxicity	No data available.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	No data available.
Acute Toxicity	Mouse LD50 (oral): 12950 mg/kg Rabbit LD50 (oral): 11250 mg/kg Rat LD50 (oral): >1000 mg/kg
Irritation	No data available.
Sensitisation	No data available.
Health Effects Summary	Poses no unreasonable risk to human health based on Tier I assessment under the NICNAS IMAP assessment framework.

Key Study/Critical Effect for Screening Criteria	The oral acute toxicity in rats was considered the most sensitive endpoint with a LD50 of 1000 mg/kg.
Ecological Toxicity [3]	
Aquatic Toxicity	Fathead minnow LC50: 810 mg/L Rainbow trout LC50: > 100 mg/L Bluegill sunfish LC50: >300 mg/L Daphnia magna LC50: 470 mg/L
Determination of PNEC aquatic	Anionic polyacrylamide has a low acute toxicity concern to aquatic organisms and thus required no further assessment.
Current Regulatory Controls	
Australian Hazard Classification	No data available.
Australian Occupational Exposure Standards	No data available.
International Occupational Exposure Standards	No data available.
Australian Food Standards	No data available.
Australian Drinking Water Guidelines	No data available.
Aquatic Toxicity Guidelines	No data available.
PBT Assessment [3]	
P/vP Criteria fulfilled?	Yes. Anionic polyacrylamide is a large molecular weight, water-soluble polymer. It is not expected to be readily biodegradable; thus, it meets the screening criteria for persistence.
B/vB criteria fulfilled?	No. 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 is thus not expected to be bioavailable to aquatic or terrestrial organisms. It is not expected to meet the criteria for bioaccumulation.
T criteria fulfilled?	No. The acute LC50 values in fish and invertebrates are >1 mg/L. Thus, it does not meet the criteria for toxicity.
Overall conclusion	Not PBT

References

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Toxicity Summary - Guar gum

Chemical and Physical Properties[1,2,7,8]	
CAS number	9000-30-0
Molecular formula	UVCB
Molecular weight	220,000 g/mol
Solubility in water	Completely soluble in water
Melting point	No data found.
Boiling point	No data found.
Vapour pressure	No data found.
Henrys law constant	No data found.
Explosive potential	No data found.
Flammability potential	No data found.
Colour/Form	Guar gum is an off-white to yellowish-white powder. Five to eight times the thickening power of starch. Water solutions are tasteless, odourless, and nontoxic and have a pale translucent gray color with neutral pH.
Overview	Guar gum is completely soluble in water and practically insoluble in oils, greases, hydrocarbons, ketones and esters. Water solutions are tasteless, odourless and a pale, translucent grey colour and neutral. The powder has 5 to 8 times the thickening power of starch. Water solution may be converted to a gel by adding a small amount of borox and are stable to heat. Guar gum is extensively used, eg typically used as a protective colloid, stabilizer, thickening and film forming agent for cheese, salad dressing, milk products including ice cream and soups; disintegration agent in tablet formulations; in pharmaceutical jelly formulations; in suspension, emulsions, lotions, creams and toothpastes; in bulk laxatives and appetite depressants; in mining industry as a flocculent, for hydraulic fracturing aid in oil well recovery and as a filtering ages; gelling and waterproofing agent in explosive and in water treatment as a coagulant. Guar gum is approved for use as a food additive by the U.S. Food and Drug Administration and is on the list of substances "generally recognized as safe" (CFR 1974). This chemical has been identified by NICNAS to be of low concern to human health based on an initial screening approach and thus required no further assessment.
Environmental Fate[1]	
Soil/Water/Air	No information was found. Guar gum, being a polysaccharide composed of galactomannan, would be expected to be readily biodegradable.
Human Health Toxicity Summary[1,2,3,4,5,6]	
Chronic Repeated Dose Toxicity	F344 rats and B6C3F1 mice were given diets containing 0, 6,300, 12,500, 25,000, 50,000 or 100,000 ppm guar gum for 13 weeks (NTP, 1982). Mean body weights were decreased in male rats (100,000 ppm group) and in female mice (50,000 and 100,000 ppm). A dose-related decrease in feed consumption was observed for male and female rats; male and female mice were comparable or higher than that of controls. There were no compound-related clinical signs or histopathological effects. F344 rats and B6C3F1 mice were given diets containing 0, 25,000 ppm or 50,000 ppm guar gum for 103 weeks (NTP, 1982). Mean body weights of the high-dose females were lower than those of the controls after week 20 for mice and week 40 for rats. No compound-related clinical signs or adverse effects on survival were observed. Feed consumption by dosed rats and mice of either sex was lower than that of controls. There were no non-neoplastic histopathological effects in either rats or mice that were treatment-related.
Carcinogenicity	F344 rats and B6C3F1 mice were given diets containing 0, 25,000 ppm or 50,000 ppm guar gum for 103 weeks (NTP, 1982). There were increased incidences of adenomas of the pituitary in male rats and pheochromocytomas of the adrenal in female rats that were statistically significant, but these differences were considered to be unrelated to guar gum administration. When pituitary adenomas or

	carcinomas and when pheochromocytomas or malignant pheochromocytomas are combined, the statistical differences disappear. Hepatocellular carcinomas occurred in treated male mice at incidences that were significantly lower than that in controls. The combined incidence of male mice with either hepatocellular adenomas or carcinomas was also significantly lower in the high-dose group. It was concluded that under conditions of this bioassay, guar gum was not carcinogenic for F344 rats or B6C3F1 mice.
Mutagenicity/ Genotoxicity	Guar gum induced no consistent responses in dominant lethal gene tests to suggest that it was mutagenic to the rat. Guar gum was not mutagenic to Salmonella typhimurium TA 1530 or G-46 when tested without metabolic activation; however, it was mutagenic to Saccharomyces cerevisiae D- 3 (Green, 1977). Guar gum also was reported to cause chromosomal aberrations in human embryonic lung cells WI-38 (Green, 1977). No in vivo genotoxicity studies have been conducted on guar gum.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	The developmental effects of guar gum were evaluated in groups of 20 rabbits by daily dermal administration of the test substance for 6 hours/day at dose levels of 0, 2, 10 and 50 mg/kg/day on days 6 through 18 of gestation. The number of early resorptions was significantly increased, and the number of viable foetuses was correspondingly decreased at 50 mg/kg/day ($p<0.05$). The NOEL was 2 mg/kg/day. The frequency of foetal malformations and variations in the treated groups was comparable to that of the control group at all dose levels. Female rabbits were given daily (6 hours/day) dermal administration of 0, 2, 10 and 50 mg/kg guar gum during gestational days 6 through 18 (IRDC, 1988). Mortalities included 2 deaths at 50 mg/kg and 1 death at 10 mg/kg. A single animal was killed in extremis. A dose-related increase in dermal irritation (including erythema, edema, and desquamation) was observed in animals receiving 10 and 50 mg/kg. The number of early resorptions was significantly increased, and the number of viable fetuses was correspondingly decreased at 50 mg/kg/day ($p<0.05$). The frequency of fetal malformations and variations in the treated groups was comparable to that of the control group at all dose levels. The NOEL for this study is 2 mg/kg/day.
Acute Toxicity	Guar gum has been blamed for causing oesophageal obstruction. A death has the use of one guar gum tablet product, which apparently swelled in the oesophagus, resulting in complications that caused the fatality. Mildly toxic by ingestion. The oral LD50 is 8,100 mg/kg for mice and 9,400 mg/kg for rats.
Irritation	No data were found.
Sensitisation	Occupational asthma has been reported in subjects of guar gum. A respiratory sensitizer There are reports of respiratory sensitization in workers exposed occupationally to guar gum dusts (Maio, 1986).
Health Effects Summary	This chemical has been identified by NICNAS to be of low concern to human health and it is listed by the US Food and Drug Administration (FDA) as a Generally Recognised as Safe (GRAS) substance.
Key Study/Critical Effect for Screening Criteria	The key studies for the determination of a drinking water guidance value is the NTP two year chronic bioassays. The LOAELs are based on decreased mean body weights in female mice and rats fed 50,000 ppm guar gum in diet for 103 weeks. The NOAELs for these studies are 25,000 ppm guar gum. Rat: NOAEL (mg/kg/day) = 25,000 ppm * 0.05 = 1,250 mg/kg/day Mouse: NOAEL (mg/kg/day) = 25,000 ppm * 0.13 = 3,250 mg/kg/day where 0.05 and 0.13 are the fraction of body weight that rats and mice, respectively, consume per day as food (U.S. EPA). The lowest NOAEL of 1,250 mg/kg/day for the rat will be used to derive a drinking water guidance value. Uncertainty factors: 10 (interspecies variability); 10 (intraspecies variability) Oral RfD = 1,250/100 = 12.5 mg/kg/day, Drinking water guideline = 49 ppm.
Ecological Toxicity[4]	
Aquatic Toxicity	The acute aquatic toxicity of guar gum is >0.1 mg/L.
Determination of PNEC aquatic	No data found.
Current Regulatory Controls	
Australian Hazard Classification	No data found.

Australian Occupational Exposure Standards	No data found.
International Occupational Exposure Standards	No data found.
Australian Food Standards	No data found.
Australian Drinking Water Guidelines	No data found.
Aquatic Toxicity Guidelines	No data found.
PBT Assessment	
P/vP Criteria fulfilled?	No biodegradation information was found on guar gum. However, guar gum is a naturally occurring polysaccharide which would be expected to readily biodegrade. Thus, it is not expected to meet the screening criteria for persistence.
B/vB criteria fulfilled?	The molecular weight of guar gum ranges from 200,000 to 300,000 daltons, and it is also water soluble. Thus, guar gum is not expected to meet the criteria for bioaccumulation.
T criteria fulfilled?	The acute aquatic toxicity of guar gum is >0.1 mg/L. Thus, guar gum is not expected to meet the screening criteria for toxicity.
Overall conclusion	Not PBT

References

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Diammonium Peroxidisulphate

Chemical and Physical Properties[2]	
CAS number	7727-54-0
Molecular formula	$H_8N_2O_8S_2$
Molecular weight	228.2 g/mol
Solubility in water	850 g/L at 25 °C
Melting point	Decomposition temperature 120°C
Boiling point	Decomposes
Vapour pressure	No data available
Henrys law constant	No data available
Explosive potential	Not explosive
Flammability potential	Not flammable
Colour/Form	White granules
Overview	Ammonium persulfate is distributed into the water compartment in the ionic form of the ammonium cation and persulfate ion. The persulfate anion will readily hydrolyze (decompose) into sulfate ions. Diammonium peroxidisulphate is a widely used reagent in biochemistry and molecular biology for the preparation of polyacrylamide gels and is also used in hair bleach.
Environmental Fate[1,4,5]	
Soil/Water/Air	The inorganic persulfates are soluble in water and their vapour pressures are negligible. Ammonium persulfate will be distributed into the water compartment in the ionic form of the ammonium cation and persulfate anion. Ammonium persulfate is expected to degrade in the environment mainly via hydrolysis, but metal catalyzed decomposition, and reactions with organic chemicals in the soil or water also are possible. Persulfates are not expected to adsorb to soil due to its dissociation properties, instability (hydrolysis) and high water solubility. Persulfates should behave as free ions or decompose into sulfate ions. In soils, upon decomposition, the cation could form more stable sulfate or bisulfate salts. Persulfates are not expected to bioaccumulate in the soil or in aqueous solution. They will decompose into inorganic sulfate or bisulfate.
Human Health Toxicity Summary[1,3,4,5,6]	
Chronic Repeated Dose Toxicity	28-day repeated dose oral (dietary) toxicity studies in rats were conducted and the NOAELs for sodium and ammonium salts were 41 mg/kg bw/day and the top dose of 137 mg/kg bw/day, respectively (FMC Corporation 1979a, 1979c). A well-conducted 90-day inhalation study of ammonium persulfate revealed evidence of inflammation of the airways, reduced body weight gain, rales, increased respiratory rate and increased lung weights at the LOAEL of 25 mg/m^3 (FMC 1998). A NOAEL of 5 mg/m^3 was identified by the OECD (2005) based on sporadic rales and respiratory effects seen (in females only) at the NOAEL of 10.3 mg/m^3. No long-term dermal studies were available. In humans, pulmonary function tests conducted on employees of a persulfate production facility indicated no adverse effects on pulmonary function at workplace levels, measured at 0.5 mg/m^3 (FMC Corporation 1992). Follow-up of these same employees indicated that exposure at 0.5 mg/m^3 had no long-term effects on pulmonary function (Greaves 1997).
Carcinogenicity	NA - not listed on Chemical Carcinogenesis Research Information System (CCRIS) or International Agency for Research on Cancer (IARC) Databases, or documented by US EPA. In a non-guideline dermal study, female SENCAR mice were exposed twice weekly to 0.2 mL of a 200 mg/mL solution of ammonium persulfate for 51 weeks (Kurokawa et al. 1984). It was concluded that ammonium persulfate is neither a tumour promoter nor a complete carcinogen when applied to the skin.

Mutagenicity/ Genotoxicity	Ammonium persulfates are not genotoxic. Negative results for mutagenicity are available from Ames tests in S. typhimurium strains TA97 or TA102 (Ishidate 1984) for ammonium persulfate. Ammonium persulfate was not clastogenic to Chinese hamster fibroblasts in the absence of metabolic activation in a chromosome aberration test (Ishidate et al. 1988).
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	In a developmental/reproduction study with ammonium persulfate in rats (OECD 421), no effects on reproductive performance, fertility, foetal anomalies, foetal viability, spermatogenesis, spermatogenic cycle were reported up to 250 mg/kg/day. Dose levels were chosen based on the acute lethality studies for the ammonium salt and on a 90-day repeat-dose study in rats with the sodium salt (high dose: 225 mg/kg/day). In the developmental/reproduction study, animals were dosed prior to and during mating through gestation until lactation day 4. There was a transient depression in pup body weight at the 250 mg/kg dose level on lactation day 0 which resolved by day 4. This effect was not considered adverse. Based on the available data, the persulfates do not show evidence of reproductive or developmental toxicity. The NOAEL is 250 mg/kg bw/day.
Acute Toxicity	The substance is irritating to the eyes, the skin and the respiratory tract. Inhalation of dust may cause asthma-like reactions. The ammonium salt gave no evidence of genotoxic activity in bacterial mutagenicity tests (including the Ames assay) or in tests for chromosomal damage with mammalian cells in culture. The acute oral LD50 for ammonium persulfate in rats is between 495 mg/kg bw to 700 mg/kg bw in females and from 600 mg/kg bw to 820 mg/kg bw in males. The acute dermal LD50s in rats and rabbits are >5,000 mg/kg. In acute inhalation studies in rats, the 4-hour LC50 was generally greater than the maximum attainable concentration (>2,950 mg/m^3 for ammonium persulfate).
Irritation	Ammonium persulfate is non-irritating to the skin in animal studies but may be slightly irritating to the eye of rabbits. There were no data available for respiratory irritation. Studies in humans indicate that aqueous solutions of 5% persulfate or higher can cause skin irritation.
Sensitisation	Results of animal skin sensitization tests (Buehler Test and Maximization Test) were negative when persulfate was applied topically but was positive when persulfate was injected intradermally in induction and challenge phases in a non-standard Maximization Test. Ammonium persulfate at approximately 50 mg/m^3 for four hours induced airway hyper-responsiveness (AHR) (Mensing et al. 1995). Numerous dermal challenge tests indicate that all persulfates are dermal and respiratory sensitizers in humans occupationally exposed to persulfates in hairdressing salons and, in one case, in a production facility.
Health Effects Summary	Ammonium persulfate have low acute dermal and inhalation toxicity but are harmful by the oral route. The chemicals were non-irritating to slightly irritating to eyes and respiratory system and not a skin irritant in animal studies, whilst studies in humans indicate that the chemicals can cause irritation. The chemicals are capable of inducing skin and respiratory sensitisation in animals and these are also the major chronic effects observed in humans. The chemicals were not genotoxic or shown to cause tumour induction or promotion in a mouse skin model. Repeated oral exposures to ammonium persulfate provided evidence that persulfates are not reproductive or developmental toxicants. Overall, the main critical effects to human health are sensitisation and irritancy.
Key Study/Critical Effect for Screening Criteria	The most sensitive endpoint was effects on the respiratory system with a NOAEC of 10.3 mg/m^3 (equivalent to (2.1 mg/kg bw/day) in a 90-day inhalation study (FMC Corporation 1998). Local effects, including respiratory tract inflammation, increased lung weight and rales were observed in rats at the LOAEC of 25 mg/m^3. Drinking water guideline value = 0.0819 ppm
Ecological Toxicity[6]	
Aquatic Toxicity	Acute Aquatic – Invertebrate The measured endpoint value for Acute Daphnia magna is 92 mg/L.
Determination of PNEC aquatic	An assessment factor of 100 has been applied the measured endpoint value for Acute Daphnia magna. The PNECaquatic is 0.92 mg/L.

Current Regulatory Controls[6]	
Australian Hazard Classification	Xn(Harmful); R22 (Harmful if swallowed) Xi (Irritant); R36/37/38 (Irritating to eyes, respiratory system and skin), R42/43 (May cause sensitisation by inhalation and skin contact).
Australian Occupational Exposure Standards	Time Weighted Average (TWA) of 0.01 mg/m^3.
International Occupational Exposure Standards	Time Weighted Average (TWA): 0.1 mg/m^3 (Belgium, Canada, Ireland, Italy, Portugal, Spain, US) 2 mg/m^3 (Denmark, Iceland, Norway)
Australian Food Standards	Ammonium persulfate is listed in Schedule 18–Processing Aids- S18.08 Permitted processing aids—Miscellaneous purposes (section 1.140): Yeast washing agent under GMP conditions (Food Standards Australia New Zealand 2013).
Australian Drinking Water Guidelines	No data available.
Aquatic Toxicity Guidelines	No data available.
PBT Assessment	
P/vP Criteria fulfilled?	No. Not applicable, inorganic salt, ionic species ubiquitous in environment.
B/vB criteria fulfilled?	No. Not applicable, inorganic salt, ionic species ubiquitous in environment.
T criteria fulfilled?	No chronic toxicity data exist; however, the acute EC(L)50s are >0.1 mg/L in fish, invertebrates and algae. Thus, does not meet the screening criteria for toxicity.
Overall conclusion	Not PBT

References

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5. OECD. Screening Information Dataset (SIDS) Initial Assessment Report for Ammonium persulfate (CAS No. 7727-54-0); Potassium persulfate (CAS No. 7727- 27-1); Sodium persulfate (CAS No. 7775-27-1), UNEP Publications, 2005.
6. Department of the Environment and Energy 2017, National assessment of chemicals associated with coal seam gas extraction in Australia, prepared by the National Industrial Chemicals Notification and Assessment Scheme.

Toxicity Summary - Boric acid

Chemical and Physical Properties[1,2,3,4,5,6,7,8]	
CAS number	Boric Acid: 10043-35-3
Molecular formula	Boric acid: H_3BO_3
Molecular weight	Boric acid: 61.833 g/mol
Solubility in water	Boric acid: 50 g/l at 25°C
Melting point	Boric Acid: 170.9°C
Boiling point	Boric Acid: 300°C
Vapour pressure	Boric acid: 9.9 x 10^{-6} Pa at 25°C
Henrys law constant	No data found
Explosive potential	Not explosive
Flammability potential	Not flammable
Colour/Form	Boric Acid: Colourless, transparent crystals or white granules or powder.
Overview	This toxicity profile includes data on boron and boric acid. In physiological conditions, aqueous solutions of simple borates will exist predominantly as un-dissociated boric acid. Therefore, the chemical and toxicological properties of simple borates such as boric acid, boric acid disodium salt and borax are expected to be similar on a mol boron/L equivalent basis when dissolved in water or biological fluids at the same pH and low concentration. Accordingly, read-across of toxicity testing results between these borate species and from other similar borate species differing only in extent of hydration was applied and testing results were expressed as boron equivalents. Boric acid and borate salts exist naturally in rocks, soil, plants and water as forms of the naturally occurring element boron. Anhydrous Borax is a free flowing mixture of clear, glass-like particles and white granules formed by the crushing of relatively large masses of fused materials. Borax is a salt of boric acid. Borax occurs naturally in evaporite deposits produced by the repeated evaporation of seasonal lakes and has many applications in chemistry, mining and pharmaceuticals. Ulexite is a sodium-calcium-hydroborate and, like other borates, is a structurally complex mineral. It is composed of hydrogen (3.98%), sodium (5.67%), calcium (9.89%), boron (13.34%), and oxygen (67.12%). There is a lack of data available in the literature to directly assess the toxicity of the chemical. The major component of the chemical is a borate ion, which is likely to be associated with human health hazards of the chemical. The other constituents are considered to be of low concern to human health (NICNAS, 2013). As the chemical will readily break down in the stomach pH to boric acid (H_3BO_3) following ingestion, the toxicokinetics and toxicity of the chemical will be driven predominantly by borate ions. Boron is a naturally occurring element that is found in the form of borates in the oceans, sedimentary rocks, coal, shale, and some soils. Boron is widely distributed in nature, with concentrations of about 10 mg/kg in the earth's crust (range 5 mg/kg in basalts to 100 mg/kg in shales) and about 4.5 mg/L in the ocean. Borates are used in glass, ceramics, detergents, wood treatment and insulation fiberglass industries. Boric acid and other borates are also used in a range of consumer products including cosmetic and personal care products and also in detergents. Moreover, borates are essential for all plants – their use as fertilizers increases crop yields (including grapes, potatoes, sugar beets, alfalfa and olives) and quality. Boron occurs in foods as borate and boric acid. Boron has not been established to be an essential nutrient for humans and no specific biochemical function for boron has been identified in higher animals or man. There is some evidence that, in humans, boron intake within the usual dietary range may influence the metabolism and utilisation of other nutrients, particularly calcium, and may have a beneficial effect on bone calcification and maintenance.

Environmental Fate[2,4,7]	
Soil/Water/Air	These forms of boron are highly soluble and not easily removed from solution by natural mechanisms. Borate and boric acid are in equilibrium depending on the pH of the water. At an acidic pH, boron exists in solution mainly as undissociated boric acid, whereas at alkaline pH it is present as borate ions. Boric acid is a persistent molecule, mobile in soil and sediment, not subject to hydrolysis, photodegradation or biodegradation. Other borates yield boric acid upon dissolution in water (or borate anion in higher pH conditions).
Human Health Toxicity Summary[2,3,4,5,6,8]	
Chronic Repeated Dose Toxicity	The haematological system and the testes have been identified as the major targets after oral repeat dose exposure to Boric acid. Studies after repeated dermal or inhalation exposure to boric acid are not available. A NOAEL for effects on testes and the blood system of 17.5 mg boron/kg bw/day can be derived (with a LOAEL of 58.5 mg boron/kg bw/day) from two 2-year studies in rats on boric acid. This NOAEL was the equivalent of 155 mg borax/kg bw/day. Results obtained with boric acid can be supported by findings obtained from other borates thus indicating that the boron ion is the toxicologically relevant species
Carcinogenicity	In two-year dietary studies on boric acid and borax in rats (Weir 1966a; Weir 1966b) (described under Section A1.6.5) no signs of carcinogenicity were observed. It has been noted that less than one third of treated animals (10 animals per sex) were used for macroscopic and histopathological examination in these studies (ECHA 2009; RIVM 2013). In a subsequent two-year dietary carcinogenicity study of boric acid in mice, animals received 0, 446 or 1150 mg boric acid (0, 75 or 200 mg boron)/kg bw /day (NTP 1987). High dose males showed testicular atrophy and interstitial cell hyperplasia. No signs of carcinogenicity were observed.
Mutagenicity/ Genotoxicity	Boric acid is not mutagenic either in vitro or in vivo. Overall, it was concluded that boric acid is unlikely to be genotoxic.
Reproductive Toxicity / Developmental Toxicity/Teratogenicity	Results from animal experiments demonstrate that boric acid adversely effects fertility and development. Feeding studies in different animal species (rats, mice and dogs) have consistently demonstrated that the male reproductive system is the principal target in experimental animals, although effects on the female reproductive system have also been reported. Testicular damage ranging from mildly inhibited spermiation to complete atrophy has been demonstrated following oral administration of boric acid. Effects on fertility were observed at lower dose levels compared to dose levels, where signs of general toxicity appeared. Based on data from the two-year feeding studies with boric acid and borax in rats, 17.5 mg boron /kg bw/day (equivalent to 100 mg boric acid/kg bw/day) was derived as a NOAEL for male and female fertility. Developmental effects have been observed in three species, rats, mice and rabbits. The most sensitive species appears to be rats, in which the effects observed at non maternally toxic doses include a reduction in foetal body weight and minor skeletal variations which, with the exception of short rib XIII, had reversed by 21 days post-natal. The NOAEL for developmental effects is 9.6 mg boron/kg bw/day (55 mg boric acid/kg/day).
Acute Toxicity	Borates are of low acute toxicity in mammals, including rats and mice. For boric acid, an oral median lethal dose (LD50) of 3765 mg/kg bw (659 mg boron/kg bw) was reported in Sprague-Dawley rats (Keller 1962; Weir and Fisher 1972). An acute oral toxicity study in rats conducted according to the Organisation for Economic Cooperation and Development (OECD) Test Guideline (TG) 401 of disodium octaborate tetrahydrate reported an LD50 of 2550 mg/kg bw (535 mg boron/kg bw) (Doyle 1988). In an acute dermal toxicity study in rats performed with disodium octaborate tetrahydrate the LD50 value was >2000 mg/kg bw (European Commission 2000). The other borates also appear to have low acute dermal toxicity. In a study in rabbits, the dermal LD50 value for boric acid was >2000 mg/kg bw/day (Weiner et al. 1982). Acute dermal toxicity studies with disodium tetraborate decahydrate (borax) and disodium tetraborate pentahydrate revealed no deaths at a limit dose of 2000 mg/kg bw/day (Reagan and Becci 1985a,c). It was noted that these studies may be flawed since the test material was not moistened, so good contact with the skin was not ensured.

	The four-hour acute median lethal concentration (LC50) for boric acid, borax and disodium borates is reported to be >2 mg boron/m3 (Hubbard 1998). An inhalation study in rats conducted to OECD TG 403 with boric acid reported an oralmedian lethal concentration (LC50) of ≥2.03 mg/L (Wnorowski 1994a). A similar study with disodium octaborate anhydrate reported an LC50 of ≥2.01 mg/L (Wnorowski 1994b).
Irritation	Borates have low skin irritation potential. In rabbits, boric acid caused no/mild skin irritation, induced reversible conjunctival redness and chemosis with minor effects on the iris. In rats and mice, boric acid acts as a sensory irritant. The substance may irritate the eyes, nasal mucous membranes, skin and the respiratory tract, and may cause effects on the gastrointestinal tract, liver and kidneys.
Sensitisation	Boric acid and borax were tested in a Buehler skin sensitisation test conducted according to OECD TG 406 (Wnorowski 1994c, 1994d). Test substances were applied at a concentration of 95% in water during both induction and challenge. No signs of skin sensitisation were seen.
Health Effects Summary	Borates are of low acute toxicity and low skin irritation potential. It may cause sensory irritant effects on animals and humans with acute exposure. Borates were shown not to be skin sensitisers, genotoxic or carcinogenic. Repeated exposures to boron as boric acid induced effects on fertility (testes), development and the blood system.
Key Study/Critical Effect for Screening Criteria	The critical lowest No Observed Adverse Effect (NOAEL) level for the purposes of risk assessment is 9.6 mg boron/kg bw/day. This NOAEL was the equivalent of 55 mg boric acid/kg bw/day; 38 mg disodium octaborate anhydrate/kg bw/day and 85 mg borax/kg bw/day), from feeding (dietary intake) studies based on developmental effects. Uncertainty factors: 10 (interspecies variability); 10 (intraspecies variability) Drinking water guideline for boron: 2.145 mg/L
Ecological Toxicity[2,7]	
Aquatic Toxicity	The most sensitive tests report that acute effects on fish are in the range of 10 - 20 mg-B/L although the quality of these studies was rated low. The lowest daphnid acute value is 133 mg-B/L. Algal and microbial inhibition studies suggest less toxicity: Selenastrum growth was not affected at 93 mg-B/L and activated sludge respiration showed minimal effects at 683 mg/L boric acid (119 mg-B/L). Chronic endpoints for Boric acid were available for Daphnia (6 mg/L) and Fish (2.1 mg/L).
Determination of PNEC aquatic	Canadian Water Quality Guidelines for the Protection of Aquatic Life: Long–term Exposure to Boron is 1.5 mg/L (2009). An assessment factor of 100 has been applied to the lowest reported chronic effect concentration of 2.1 mg/L for Fish. The PNECaquatic is 0.021 mg/L.
Current Regulatory Controls[6,8]	
Australian Hazard Classification	Boric acid and borax are classified as hazardous for human health in the Hazardous Substances Information System (HSIS) (Safe Work Australia 2013) with the following risk phrases: - Toxic to reproduction (Repr.) Cat. 2; R60 (May impair fertility) - Repr. Cat. 2; R61 (May cause harm to the unborn child) Mixtures containing boric acid and borax are classified as hazardous with the following risk phrases based on the concentration (conc) of the chemicals in the mixtures. - Boric acid: Conc ≥5.5%: Toxic (T); R60; R61 - Borax: Conc ≥8.5%: T; R60; R61.
Australian Occupational Exposure Standards	There are no specific exposure standards for boric acid. However, the permissible exposure limits (as the time weighted average (TWA)) for dusts apply (10 mg/m^3 measured as inspirable dust) (Safe Work Australia 2013b). The exposure standard for borax is 5 mg/m^3 TWA (Safe Work Australia 2013a).

International Occupational Exposure Standards	Boric Acid: Canada 2 mg/m^3 TWA, 6 mg/m^3 Short-term exposure limit (STEL) (borate compounds) Germany 10 mg/m^3 TWA; 1 mg/m^3 STEL Spain 10 mg/m^3 TWA (insoluble particles) US 2 mg/m^3 TWA; 6 mg/m^3 STEL (borate compounds), 5 mg/m^3 TWA (particulates, respirable fraction)
Australian Food Standards	No data found.
Australian Drinking Water Guidelines	No data found. However, boron in the environment is likely to be predominantly in the form of boric acid and that based on health considerations, the concentration of boron in drinking water should not exceed 4 mg/L (NHMRC 2011).
Aquatic Toxicity Guidelines	For boron: 90 µg/L (ANZECC 2000 99% Freshwater)
PBT Assessment	
P/vP Criteria fulfilled?	For the purposes of this PBT assessment, the persistent criteria is not considered applicable to this inorganic substance.
B/vB criteria fulfilled?	For the purposes of this PBT assessment, the bioaccumulation criteria is not considered applicable to this inorganic substance.
T criteria fulfilled?	No. The chronic toxicity data is >1 mg/L.
Overall conclusion	Not PBT

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3. EFSA, Opinion of the Scientific Panel on Dietetic Products, Nutrition and Allergies on a request from the Commission related to the Tolerable Upper Intake Level of Boron (Sodium Borate and Boric Acid), 2004
4. Draft European Union Risk Assessment Report. Disodium tetraborate, Anhydrous Boric Acid, Boric Acid, Crude natural (1) Risk Assessment. 2007.
5. EFSA, European Food Safety Authority, Scientific Opinion on the re-evaluation of boric acid (E284) and sodium tetraborate (borax) (E285) as food additives. 2013.
6. Australian Industrial Chemicals Introduction Scheme (AICIS) online database. IMAP, Human Health Tier II Assessment for Boric acid, 2020.
7. Australian Industrial Chemicals Introduction Scheme (AICIS) online database. IMAP, Environment Tier II Assessment for Boric acid and Precursors to Boric Acid, 2020.
8. Department of the Environment and Energy 2017, National assessment of chemicals associated with coal seam gas extraction in Australia, prepared by the National Industrial Chemicals Notification and Assessment Scheme.

Appendix D

Safety Data Sheet

SECTION 1: IDENTIFICATION

1.1 Product identifier: LGA-01F

Other means of identification:

Not available

1.2 Recommended use of the chemical and restrictions on use:

Relevant uses: Gelling agent . For professional users only.

Uses advised against: All uses not specified in this section or in section 7.3

1.3 Details of manufacturer or importer:

Fusion Technologies (Australia) Pty
Unit 3, 1472 Boundary Road
Wacol, Queensland 4076, Australia
Phone: +61 460 047 656
https://www.fusiontechinc.net/

Technical Inquries: help@fusiontechinc.net

1.4 Emergency phone number: **AU 1800 033 111 NZ 0800 734 607 (ALL HOURS)**

SECTION 2: HAZARD(S) IDENTIFICATION

2.1 Classification of the hazardous chemical:

This product contains crystalline silica but due to its liquid state does not require classification (STOT RE)

WHS:

Classification of this product has been carried out in accordance with Model Work Health and Safety Regulations(Hazardous Chemicals) Amendment 2022

Asp. Tox. 1: Aspiration hazard, Category 1, H304
Carc. 1B: Carcinogenicity, Category 1B, H350
Flam. Liq. 4: Flammable liquids, Category 4, H227

2.2 Label elements, including precautionary statements:

WHS:

Danger

Hazard statements:

Asp. Tox. 1: H304 - May be fatal if swallowed and enters airways.
Carc. 1B: H350 - May cause cancer.
Flam. Liq. 4: H227 - Combustible liquid.

Precautionary statements:

P201: Obtain special instructions before use.
P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P280: Wear protective gloves/protective clothing/respiratory protection/eye protection/protective footwear.
P301+P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P308+P313: IF exposed or concerned: Get medical advice/attention.
P370+P378: In case of fire: Use Foam extinguisher (AB), Dry Chemical Powder (ABC) Fire Extinguisher, Carbon dioxide extinguisher (BC) to extinguish.
P403: Store in a well-ventilated place.
P501: Dispose of contents and / or containers in accordance with regulations on hazardous waste or packaging and packaging waste respectively.

Substances that contribute to the classification

Distillates (petroleum), hydrotreated light (30 - <60 %); Organophillic silicate (<10 %)

2.3 Other hazards which do not result in classification:

Not available

- CONTINUED ON NEXT PAGE -

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

3.1 Substances:

Non-applicable

3.2 Mixtures:

Chemical description: Polymer/s

Components:

In accordance with Schedule 8 (WHS Regulations), the product contains:

Identification	Chemical name/Classification	Concentration
CAS: 64742-47-8	**Distillates (petroleum), hydrotreated light** Asp. Tox. 1: H304; Flam. Liq. 4: H227 - Danger	**30 - <60 %**
CAS: 127087-87-0	**Glycol ether derivative** Eye Irrit. 2A: H319; Skin Irrit. 2: H315 - Warning	**<10 %**
CAS: Proprietary	**Organophillic silicate** Carc. 1B: H350; STOT RE 1: H372 - Danger	**<5 %**

To obtain more information on the hazards of the substances consult sections 11, 12 and 16.

SECTION 4: FIRST AID MEASURES

4.1 Description of necessary first aid measures:

The symptoms resulting from intoxication can appear after exposure, therefore, in case of doubt, seek medical attention for direct exposure to the chemical product or persistent discomfort, showing the SDS of this product.

By inhalation:

Remove the person affected from the area of exposure, provide with fresh air and keep at rest. In serious cases such as cardiorespiratory failure, artificial resuscitation techniques will be necessary (mouth to mouth resuscitation, cardiac massage, oxygen supply, etc.) requiring immediate medical assistance.

By skin contact:

This product is not classified as hazardous when in contact with the skin. However, in case of skin contact it is recommended to remove contaminated clothes and shoes, rinse the skin or shower the person affected if necessary thoroughly with cold water and neutral soap. In case of serious reaction consult a doctor.

By eye contact:

Rinse eyes thoroughly with water for at least 15 minutes. If the injured person uses contact lenses, these should be removed unless they are stuck to the eyes, as this could cause further damage. In all cases, after cleaning, a doctor should be consulted as quickly as possible with the SDS of the product.

By ingestion/aspiration:

Request medical assistance immediately, showing the SDS of this product. Do not induce vomiting, but if it does happen keep the head down to avoid aspiration. In the case of loss of consciousness do not administrate anything orally unless supervised by a doctor. Rinse out the mouth and throat, as they may have been affected during ingestion. Keep the person affected at rest.

4.2 Symptoms caused by exposure:

Acute and delayed effects are indicated in sections 2 and 11.

4.3 Medical attention and special treatment:

Not available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable extinguishing equipment:

Suitable extinguishing media:

Foam extinguisher (AB), Dry Chemical Powder (ABC) Fire Extinguisher, Carbon dioxide extinguisher (BC)

Unsuitable extinguishing media:

Water jet - Spills will create slippery surfaces which could worsen with addition of water.

5.2 Specific hazards arising from the chemical:

- CONTINUED ON NEXT PAGE -

SECTION 5: FIREFIGHTING MEASURES (continued)

As a result of combustion or thermal decomposition reactive sub-products are created that can become highly toxic and, consequently, can present a serious health risk.

5.3 Special protective equipment and precautions for fire fighters:

Depending on the magnitude of the fire it may be necessary to use full protective clothing and individual respiratory equipment. Minimum emergency facilities and equipment should be available (fire blankets, portable first aid kit,...)

Additional provisions:

Act in accordance with the Internal Emergency Plan and the Information Sheets on actions to take after an accident or other emergencies. Destroy any source of ignition. In case of fire, refrigerate the storage containers and tanks for products susceptible to inflammation, explosion or BLEVE as a result of high temperatures. Avoid spillage of the products used to extinguish the fire into an aqueous medium.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures:

For non-emergency personnel:

Isolate leaks provided that there is no additional risk for the people performing this task. Personal protection equipment must be used against potential contact with the spilt product (See section 8). Evacuate the area and keep out those who do not have protection.

For emergency responders:

Wear protective equipment. Keep unprotected persons away. See section 8.

6.2 Environmental precautions:

This product is not classified as hazardous to the environment. Keep product away from drains, surface and underground water.

6.3 Methods and materials for containment and cleaning up:

It is recommended: Spills will create slippery surfaces which could worsen with addition of water.

Absorb the spillage using sand or inert absorbent and move it to a safe place. Do not absorb in sawdust or other combustible absorbents. For any concern related to disposal consult section 13.

6.4 Reference to other sections:

See sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling:

A.- General precautions for safe use

Comply with the current legislation concerning the prevention of industrial risks with regards manually handling weights. Maintain order, cleanliness and dispose of using safe methods (section 6).

B.- Technical recommendations for the prevention of fires and explosions

Product is non-flammable under normal conditions of storage, manipulation and use. It is recommended to transfer at slow speeds to avoid the generation of electrostatic charges that can affect flammable products. Consult section 10 for information on conditions and materials that should be avoided.

C.- Technical recommendations on general occupational hygiene

Do not eat or drink during the process, washing hands afterwards with suitable cleaning products.

D.- Technical recommendations to prevent environmental risks

It is recommended to have absorbent material available at close proximity to the product (See subsection 6.3)

7.2 Conditions for safe storage, including any incompatibilities:

A.- Specific storage requirements

Minimum Temp.:	5 ºC
Maximum Temp.:	40 ºC
Maximum time:	6 Months

B.- General conditions for storage

Avoid sources of heat, radiation, static electricity and contact with food. For additional information see subsection 10.5

7.3 Specific end use(s):

- CONTINUED ON NEXT PAGE -

SECTION 7: HANDLING AND STORAGE (continued)

Except for the instructions already specified it is not necessary to provide any special recommendation regarding the uses of this product.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 Exposure control measures:

Substances whose occupational exposure limits have to be monitored in the workplace:

Workplace Exposure Standards for Airborne Contaminants 01/10/2022:

Identification	Occupational exposure limits		
Organophillic silicate	TWA		0.05 mg/m³
CAS: 14808-60-7	STEL		

8.2 Engineering controls:

A.- Individual protection measures, for example personal protective equipment (PPE)

In accordance with the order of importance to control professional exposure it is recommended to use localized extraction in the work area as a collective protection measure to avoid exceeding the professional exposure limits. In case of using individual protection equipment. For more information on Personal Protection Equipment (storage, use, cleaning, maintenance, class of protection,…) consult the information leaflet provided by the manufacturer. For additional information see subsection 7.1.
All information contained herein is a recommendation which needs some specification from the labour risk prevention services as it is not known whether the company has additional measures at its disposal.

B.- Respiratory protection

Pictogram	PPE	Remarks
 Mandatory respiratory tract protection	Filter mask for gases and vapours	Replace when there is a taste or smell of the contaminant inside the face mask. If the contaminant comes with warnings it is recommended to use isolation equipment.

C.- Specific protection for the hands

Pictogram	PPE	Remarks
 Mandatory hand protection	Chemical protective gloves (Material: Nitrile, Thickness: 0.3 mm)	Replace the gloves at any sign of deterioration.

As the product is a mixture of several substances, the resistance of the glove material can not be calculated in advance with total reliability and has therefore to be checked prior to the application.

D.- Eye and face protection

Pictogram	PPE	Remarks
 Mandatory face protection	Panoramic glasses against splash/projections.	Clean daily and disinfect periodically according to the manufacturer´s instructions. Use if there is a risk of splashing.

E.- Bodily protection

Pictogram	PPE	Remarks
	Work clothing	Replace before any evidence of deterioration.
	Anti-slip work shoes	Replace before any evidence of deterioration.

F.- Additional emergency measures

- CONTINUED ON NEXT PAGE -

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION (continued)

Emergency measure	Standards	Emergency measure	Standards
 Emergency shower	ANSI Z358-1 ISO 3864-1:2011, ISO 3864-4:2011	 Eyewash stations	DIN 12 899 ISO 3864-1:2011, ISO 3864-4:2011

Environmental exposure controls:

In accordance with the community legislation for the protection of the environment it is recommended to avoid environmental spillage of both the product and its container. For additional information see subsection 7.1.D

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties:

For complete information see the product datasheet.

Appearance:

Physical state at 20 ºC:	Liquid
Appearance:	Slurry
Color:	Beige
Odor:	Hydrocarbon
Odour threshold:	Not available *

Volatility:

Boiling point at atmospheric pressure:	Not available *
Vapour pressure at 20 ºC:	Not available *
Vapour pressure at 50 ºC:	33.42 Pa (0.03 kPa)
Evaporation rate at 20 ºC:	Not available *

Product description:

Density at 20 ºC:	Not available *
Relative density at 20 ºC:	1.03 - 1.09
Dynamic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 40 ºC:	<20.5 mm²/s
Concentration:	Not available *
pH:	7.0 +/- 1.0
Vapour density at 20 ºC:	Not available *
Partition coefficient n-octanol/water 20 ºC:	Not available *
Solubility in water at 20 ºC:	Not available *
Solubility properties:	Partially water-soluble
Decomposition temperature:	Not available *
Melting point/freezing point:	< -15°C

Flammability:

Flash Point:	77 ºC
Flammability (solid, gas):	Not available *
Autoignition temperature:	Not available *
Lower flammability limit:	Not available *
Upper flammability limit:	Not available *

Particle characteristics:

Median equivalent diameter:	Non-applicable

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

9.2 Other information:

Information with regard to physical hazard classes:

Explosive properties:	Not available *
Oxidising properties:	Not available *
Corrosive to metals:	Not available *
Heat of combustion:	Not available *
Aerosols-total percentage (by mass) of flammable components:	Not available *

Other safety characteristics:

Surface tension at 20 ºC:	Not available *
Refraction index:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity:

No hazardous reactions are expected because the product is stable under recommended storage conditions. See section 7 from Safety Data Sheet.

10.2 Chemical stability:

Chemically stable under the indicated conditions of storage, handling and use.

10.3 Possibility of hazardous reactions:

Under the specified conditions, hazardous reactions that lead to excessive temperatures or pressure are not expected.

10.4 Conditions to avoid:

Applicable for handling and storage at room temperature:

Shock and friction	Contact with air	Increase in temperature	Sunlight	Humidity
Not applicable	Not applicable	Risk of combustion	Avoid direct impact	Not applicable

10.5 Incompatible materials:

Acids	Water	Oxidising materials	Combustible materials	Others
Avoid strong acids	Not applicable	Not applicable	Not applicable	Avoid alkalis or strong bases

10.6 Hazardous decomposition products:

See subsection 10.3, 10.4 and 10.5 to find out the specific decomposition products. Depending on the decomposition conditions, complex mixtures of chemical substances can be released: carbon dioxide (CO_2), carbon monoxide and other organic compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects:

The experimental information related to the toxicological properties of the product itself is not available

Dangerous health implications:

In case of exposure that is repetitive, prolonged or at concentrations higher than recommended by the occupational exposure limits, it may result in adverse effects on health depending on the means of exposure:

A- Ingestion (acute effect):

- Acute toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for consumption. For more information see section 3
- Corrosivity/Irritability: Based on available data, the classification criteria are not met. However, it does contain substances classified as hazardous for this effect. For more information see section 3.

B- Inhalation (acute effect):

- Acute toxicity : Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for inhalation. For more information see section 3.
- Corrosivity/Irritability: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

- CONTINUED ON NEXT PAGE -

SECTION 11: TOXICOLOGICAL INFORMATION (continued)

C- Contact with the skin and the eyes (acute effect):

- Contact with the skin: Based on available data, the classification criteria are not met. However, it contains substances classified as hazardous for skin contact. For more information see section 3.
- Contact with the eyes: Based on available data, the classification criteria are not met. However, it does contain substances classified as hazardous for this effect. For more information see section 3.

D- CMR effects (carcinogenicity, mutagenicity and toxicity to reproduction):

- Carcinogenicity: Exposure to this product can cause cancer. For more specific information on the possible health effects see section 2.
  IARC: Organophillic silicate (1)
- Mutagenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Reproductive toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

E- Sensitizing effects:

- Respiratory: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous with sensitising effects. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

F- Specific target organ toxicity (STOT) - single exposure:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

G- Specific target organ toxicity (STOT)-repeated exposure:

- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

H- Aspiration hazard:

May be fatal if swallowed and enters airways.

Other information:

Contains substances that have been listed by the International Agency for Research on Cancer (IARC) as Group 1 human carcinogens. However, exposure to such substances does not occur during normal use of products in which the substance is bound to other materials, such as rubber, inks, paints, etc., in a liquid state or polymer-encapsulated.

Specific toxicology information on the substances:

Not available

SECTION 12: ECOLOGICAL INFORMATION

The experimental information related to the eco-toxicological properties of the product itself is not available

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

12.1 Ecotoxicity:

Not available

12.2 Persistence and degradability:

Not available

12.3 Bioaccumulative potential:

Not available

12.4 Mobility in soil:

Not available

12.5 Results of PBT and vPvB assessment:

Non-applicable

12.6 Other adverse effects:

- CONTINUED ON NEXT PAGE -

SECTION 12: ECOLOGICAL INFORMATION (continued)

Not described

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Disposal methods:

Waste management (disposal and evaluation):

Consult the authorized waste service manager on the assessment and disposal operations. In case the container has been in direct contact with the product, it will be processed the same way as the actual product. Otherwise, it will be processed as non-hazardous residue. Waste should not be disposed of to drains. See epigraph 6.2.

Regulations related to waste management:

Legislation related to waste management:

Basel Convention (Hazardous Waste)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 and Amendments

SECTION 14: TRANSPORT INFORMATION

This product is not regulated for transport.

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations:

Specific provisions in terms of protecting people or the environment:

It is recommended to use the information included in this safety data sheet as data used in a risk evaluation of the local circumstances in order to establish the necessary risk prevention measures for the manipulation, use, storage and disposal of this product.

Industrial Chemicals Act 2019:

Industrial Chemicals (Notification and Assessment) Act 1989

SECTION 16: OTHER INFORMATION

Legislation related to safety data sheets:
This safety data sheet has been designed in accordance with WHS regulations and Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Texts of the legislative phrases mentioned in section 2:
H350: May cause cancer.
H304: May be fatal if swallowed and enters airways.
H227: Combustible liquid.

Texts of the legislative phrases mentioned in section 3:
The phrases indicated do not refer to the product itself; they are present merely for informative purposes and refer to the individual components which appear in section 3

WHS:
Asp. Tox. 1: H304 - May be fatal if swallowed and enters airways.
Carc. 1B: H350 - May cause cancer.
Eye Irrit. 2A: H319 - Causes serious eye irritation.
Flam. Liq. 4: H227 - Combustible liquid.
Skin Irrit. 2: H315 - Causes skin irritation.

Advice related to training:
Minimal training is recommended to prevent industrial risks for staff using this product, in order to facilitate their comprehension and interpretation of this safety data sheet, as well as the label on the product.

Principal bibliographical sources:
http://www.safeworkaustralia.gov.au/

Abbreviations and acronyms:

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SECTION 16: OTHER INFORMATION (continued)

ADG: Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG: International maritime dangerous goods code
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
COD: Chemical Oxygen Demand
BOD5: 5-day biochemical oxygen demand
BCF: Bioconcentration factor
LD50: Lethal Dose 50
CL50: Lethal Concentration 50
EC50: Effective concentration 50
Log-POW: Octanol-water partition coefficient
Koc: Partition coefficient of organic carbon
IARC: International Agency for Research on Cancer

END OF SAFETY DATA SHEET

SECTION 1: IDENTIFICATION

1.1 Product identifier: SCI-1F

Other means of identification:

Not available

1.2 Recommended use of the chemical and restrictions on use:

Relevant uses: Scale inhibitor. For professional users only.

Uses advised against: All uses not specified in this section or in section 7.3

1.3 Details of manufacturer or importer:

Fusion Technologies (Australia) Pty
Unit 3, 1472 Boundary Road
Wacol, Queensland 4076, Australia
Phone: +61 460 047 656
https://www.fusiontechinc.net/

Technical Inquries: help@fusiontechinc.net

1.4 Emergency phone number: **AU 1800 033 111 NZ 0800 734 607 (ALL HOURS)**

SECTION 2: HAZARD(S) IDENTIFICATION

2.1 Classification of the hazardous chemical:

WHS:

The product is not classified as dangerous according to Model Work Health and Safety Regulations(Hazardous Chemicals) Amendment 2020

2.2 Label elements, including precautionary statements:

WHS:

None

2.3 Other hazards which do not result in classification:

Not available

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

3.1 Substances:

Non-applicable

3.2 Mixtures:

Chemical description: Mixture of substances

Components:

None of the substances contained in the mixture are above the values fixed in the Schedule 8 (WHS Regulations).

SECTION 4: FIRST AID MEASURES

4.1 Description of necessary first aid measures:

Consult a doctor in case of discomfort with this Safety data Sheet.

By inhalation:

In case of symptoms, move the person affected into fresh air.

By skin contact:

In case of contact it is recommended to clean the affected area thoroughly with water and neutral soap. In case of changes to the skin (stinging, redness, rashes, blisters,…), seek medical advice with this Safety Data Sheet

By eye contact:

Rinse with water until the product has been eliminated. In case of problems, consult a doctor with the SDS of this product.

By ingestion/aspiration:

In case of consumption in large quantities, it is recommended to seek medical assistance.

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SECTION 4: FIRST AID MEASURES (continued)

4.2 Symptoms caused by exposure:

Acute and delayed effects are indicated in sections 2 and 11.

4.3 Medical attention and special treatment:

Not available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable extinguishing equipment:

Suitable extinguishing media:

Product is non-flammable, low risk of fire by the inflammability characteristics of the product in normal conditions of storage, manipulation and use. In the case of the existence of sustained combustion as a result of improper manipulation, storage or use any type of extinguishing agent can be used (ABC Powder, water,...)

Unsuitable extinguishing media:

Non-applicable

5.2 Specific hazards arising from the chemical:

Due to its non-flammable nature, the product does not present a fire risk under normal conditions of storage, manipulation and use.

5.3 Special protective equipment and precautions for fire fighters:

Depending on the magnitude of the fire it may be necessary to use full protective clothing and individual respiratory equipment. Minimum emergency facilities and equipment should be available (fire blankets, portable first aid kit,...)

Additional provisions:

Act in accordance with the Internal Emergency Plan and the Information Sheets on actions to take after an accident or other emergencies. Destroy any source of ignition. In case of fire, refrigerate the storage containers and tanks for products susceptible to inflammation, explosion or BLEVE as a result of high temperatures. Avoid spillage of the products used to extinguish the fire into an aqueous medium.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures:

For non-emergency personnel:

Isolate leaks provided that there is no additional risk for the people performing this task.

For emergency responders:

Wear protective equipment. Keep unprotected persons away. See section 8.

6.2 Environmental precautions:

This product is not classified as hazardous to the environment. Keep product away from drains, surface and underground water.

6.3 Methods and materials for containment and cleaning up:

It is recommended:

Absorb the spillage using sand or inert absorbent and move it to a safe place. Do not absorb in sawdust or other combustible absorbents. For any concern related to disposal consult section 13.

6.4 Reference to other sections:

See sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling:

A.- General precautions for safe use

Comply with the current legislation concerning the prevention of industrial risks with regards manually handling weights. Maintain order, cleanliness and dispose of using safe methods (section 6).

B.- Technical recommendations for the prevention of fires and explosions

It is recommended to transfer at a slow speed to avoid the creation of electrostatic charges that could affect flammable products. Consult section 10 for conditions and materials that should be avoided.

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SECTION 7: HANDLING AND STORAGE (continued)

C.- Technical recommendations on general occupational hygiene

Do not eat or drink during the process, washing hands afterwards with suitable cleaning products.

D.- Technical recommendations to prevent environmental risks

It is not necessary to take special measures to prevent environmental risks. For more information see subsection 6.2

7.2 Conditions for safe storage, including any incompatibilities:

A.- Specific storage requirements

Minimum Temp.: 5 ºC

Maximum Temp.: 40 ºC

Maximum time: 6 Months

B.- General conditions for storage

Avoid sources of heat, radiation, static electricity and contact with food. For additional information see subsection 10.5

7.3 Specific end use(s):

Except for the instructions already specified it is not necessary to provide any special recommendation regarding the uses of this product.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 Exposure control measures:

Substances whose occupational exposure limits have to be monitored in the workplace:

There are no applicable occupational exposure limits for the substances contained in the product

8.2 Engineering controls:

A.- Individual protection measures, for example personal protective equipment (PPE)

As a preventative measure it is recommended to use basic Personal Protection Equipment. For more information on Personal Protection Equipment (storage, use, cleaning, maintenance, class of protection,…) consult the information leaflet provided by the manufacturer. For more information see subsection 7.1.
All information contained herein is a recommendation which needs some specification from the labour risk prevention services as it is not known whether the company has additional measures at its disposal.

B.- Respiratory protection

The use of protection equipment will be necessary if a mist forms or if the occupational exposure limits are exceeded.

C.- Specific protection for the hands

Pictogram	PPE	Remarks
 Mandatory hand protection	Protective gloves against minor risks	Replace gloves in case of any sign of damage. For prolonged periods of exposure to the product for professional users/industrials, we recommend using chemical protection gloves

As the product is a mixture of several substances, the resistance of the glove material can not be calculated in advance with total reliability and has therefore to be checked prior to the application.

D.- Eye and face protection

Pictogram	PPE	Remarks
 Mandatory face protection	Panoramic glasses against splash/projections.	Clean daily and disinfect periodically according to the manufacturer´s instructions. Use if there is a risk of splashing.

E.- Bodily protection

Pictogram	PPE	Remarks
	Work clothing	Replace before any evidence of deterioration.

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SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION (continued)

Pictogram	PPE	Remarks
	Anti-slip work shoes	Replace before any evidence of deterioration.

F.- Additional emergency measures

It is not necessary to take additional emergency measures.

Environmental exposure controls:

In accordance with the community legislation for the protection of the environment it is recommended to avoid environmental spillage of both the product and its container. For additional information see subsection 7.1.D

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties:

For complete information see the product datasheet.

Appearance:

Physical state at 20 ºC:	Liquid
Appearance:	Transparent
Color:	Amber
Odor:	Characteristic
Odour threshold:	Not available *
Volatility:	
Boiling point at atmospheric pressure:	100 ºC
Vapour pressure at 20 ºC:	Not available *
Vapour pressure at 50 ºC:	12381.01 Pa (12.38 kPa)
Evaporation rate at 20 ºC:	Not available *
Product description:	
Density at 20 ºC:	Not available *
Relative density at 20 ºC:	1.03 - 1.05
Dynamic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 40 ºC:	Not available *
Concentration:	Not available *
pH:	6 - 8
Vapour density at 20 ºC:	Not available *
Partition coefficient n-octanol/water 20 ºC:	Not available *
Solubility in water at 20 ºC:	Not available *
Solubility properties:	Soluble
Decomposition temperature:	Not available *
Melting point/freezing point:	-5 ºC
Flammability:	
Flash Point:	Non Flammable (>93 ºC)
Flammability (solid, gas):	Not available *
Autoignition temperature:	Not available *
Lower flammability limit:	Not available *
Upper flammability limit:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

Particle characteristics:

Median equivalent diameter:	Non-applicable

9.2 Other information:

Information with regard to physical hazard classes:

Explosive properties:	Not available *
Oxidising properties:	Not available *
Corrosive to metals:	Not available *
Heat of combustion:	Not available *
Aerosols-total percentage (by mass) of flammable components:	Not available *

Other safety characteristics:

Surface tension at 20 ºC:	Not available *
Refraction index:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity:

No hazardous reactions are expected because the product is stable under recommended storage conditions. See section 7 from Safety Data Sheet.

10.2 Chemical stability:

Chemically stable under the indicated conditions of storage, handling and use.

10.3 Possibility of hazardous reactions:

Under the specified conditions, hazardous reactions that lead to excessive temperatures or pressure are not expected.

10.4 Conditions to avoid:

Applicable for handling and storage at room temperature:

Shock and friction	Contact with air	Increase in temperature	Sunlight	Humidity
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

10.5 Incompatible materials:

Acids	Water	Oxidising materials	Combustible materials	Others
Avoid strong acids	Not applicable	Not applicable	Not applicable	Avoid alkalis or strong bases

10.6 Hazardous decomposition products:

See subsection 10.3, 10.4 and 10.5 to find out the specific decomposition products. Depending on the decomposition conditions, complex mixtures of chemical substances can be released: carbon dioxide (CO_2), carbon monoxide and other organic compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects:

LD50 oral > 5000 mg/kg (rat)

Dangerous health implications:

In case of exposure that is repetitive, prolonged or at concentrations higher than recommended by the occupational exposure limits, it may result in adverse effects on health depending on the means of exposure:

A- Ingestion (acute effect):

- Acute toxicity: Based on available data, the classification criteria are not met
- Corrosivity/Irritability: Based on available data, the classification criteria are not met

B- Inhalation (acute effect):

- Acute toxicity : Based on available data, the classification criteria are not met
- Corrosivity/Irritability: Based on available data, the classification criteria are not met

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SECTION 11: TOXICOLOGICAL INFORMATION (continued)

C- Contact with the skin and the eyes (acute effect):

- Contact with the skin: Based on available data, the classification criteria are not met
- Contact with the eyes: Based on available data, the classification criteria are not met

D- CMR effects (carcinogenicity, mutagenicity and toxicity to reproduction):

- Carcinogenicity: Based on available data, the classification criteria are not met
  IARC: Not available
- Mutagenicity: Based on available data, the classification criteria are not met
- Reproductive toxicity: Based on available data, the classification criteria are not met

E- Sensitizing effects:

- Respiratory: Based on available data, the classification criteria are not met
- Skin: Based on available data, the classification criteria are not met

F- Specific target organ toxicity (STOT) - single exposure:

Based on available data, the classification criteria are not met

G- Specific target organ toxicity (STOT)-repeated exposure:

- Specific target organ toxicity (STOT)-repeated exposure: Based on available data, the classification criteria are not met
- Skin: Based on available data, the classification criteria are not met

H- Aspiration hazard:

Based on available data, the classification criteria are not met

Other information:

Not available

Specific toxicology information on the substances:

Not available

SECTION 12: ECOLOGICAL INFORMATION

The experimental information related to the eco-toxicological properties of the product itself is not available

Based on available data, the classification criteria are not met

12.1 Ecotoxicity:

Not available

12.2 Persistence and degradability:

Not available

12.3 Bioaccumulative potential:

Not available

12.4 Mobility in soil:

Not available

12.5 Results of PBT and vPvB assessment:

Non-applicable

12.6 Other adverse effects:

Not described

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Disposal methods:

Waste management (disposal and evaluation):

Consult the authorized waste service manager on the assessment and disposal operations. In case the container has been in direct contact with the product, it will be processed the same way as the actual product. Otherwise, it will be processed as non-hazardous residue. Waste should not be disposed of to drains. See epigraph 6.2.

Regulations related to waste management:

- CONTINUED ON NEXT PAGE -

SECTION 13: DISPOSAL CONSIDERATIONS (continued)

Legislation related to waste management:

Basel Convention (Hazardous Waste)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 and Amendments

SECTION 14: TRANSPORT INFORMATION

This product is not regulated for transport.

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations:

Specific provisions in terms of protecting people or the environment:

It is recommended to use the information included in this safety data sheet as data used in a risk evaluation of the local circumstances in order to establish the necessary risk prevention measures for the manipulation, use, storage and disposal of this product.

Industrial Chemicals Act 2019:

Industrial Chemicals (Notification and Assessment) Act 1989

SECTION 16: OTHER INFORMATION

Legislation related to safety data sheets:
This safety data sheet has been designed in accordance with WHS regulations and Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Texts of the legislative phrases mentioned in section 3:
The phrases indicated do not refer to the product itself; they are present merely for informative purposes and refer to the individual components which appear in section 3

WHS:
Not available

Advice related to training:
Minimal training is recommended to prevent industrial risks for staff using this product, in order to facilitate their comprehension and interpretation of this safety data sheet, as well as the label on the product.

Principal bibliographical sources:
http://www.safeworkaustralia.gov.au/

Abbreviations and acronyms:
ADG: Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG: International maritime dangerous goods code
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
COD: Chemical Oxygen Demand
BOD5: 5-day biochemical oxygen demand
BCF: Bioconcentration factor
LD50: Lethal Dose 50
CL50: Lethal Concentration 50
EC50: Effective concentration 50
Log-POW: Octanol-water partition coefficient
Koc: Partition coefficient of organic carbon
IARC: International Agency for Research on Cancer

END OF SAFETY DATA SHEET

SECTION 1: IDENTIFICATION

1.1 Product identifier: SFT-NE-1F

Other means of identification:

Not available

1.2 Recommended use of the chemical and restrictions on use:

Relevant uses: Demulsifier. For professional users only.

Uses advised against: All uses not specified in this section or in section 7.3

1.3 Details of manufacturer or importer:

Fusion Technologies (Australia) Pty
Unit 3, 1472 Boundary Road
Wacol, Queensland 4076, Australia
Phone: +61 460 047 656
https://www.fusiontechinc.net/

Technical Inquries: help@fusiontechinc.net

1.4 Emergency phone number: **AU 1800 033 111 NZ 0800 734 607 (ALL HOURS)**

SECTION 2: HAZARD(S) IDENTIFICATION

2.1 Classification of the hazardous chemical:

WHS:

Classification of this product has been carried out in accordance with Model Work Health and Safety Regulations(Hazardous Chemicals) Amendment 2022

Eye Dam. 1: Serious eye damage, Category 1, H318
Skin Irrit. 2: Skin irritation, Category 2, H315
STOT RE 2: Specific target organ toxicity — Repeated exposure, Hazard Category 2 (Oral), H373

2.2 Label elements, including precautionary statements:

WHS:

Danger

Hazard statements:

Eye Dam. 1: H318 - Causes serious eye damage.
Skin Irrit. 2: H315 - Causes skin irritation.
STOT RE 2: H373 - May cause damage to organs through prolonged or repeated exposure (Oral).

Precautionary statements:

P260: Do not breathe vapours
P264: Wash thoroughly after use.
P280: Wear protective gloves/protective clothing/eye protection/protective footwear.
P302+P352: IF ON SKIN: Wash with plenty of soap and water.
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.
P314: Get medical advice/attention if you feel unwell.
P501: Dispose of contents and / or containers in accordance with regulations on hazardous waste or packaging and packaging waste respectively.

2.3 Other hazards which do not result in classification:

Not available

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

3.1 Substances:

- CONTINUED ON NEXT PAGE -

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8 (continued)

Non-applicable

3.2 Mixtures:

Chemical description: Mixture of substances

Components:

In accordance with Schedule 8 (WHS Regulations), the product contains:

Identification	Chemical name/Classification	Concentration
CAS: Proprietary	**Nonionic Surfactant** Eye Dam. 1: H318; Skin Irrit. 2: H315 - Danger	**10 - <30 %**
CAS: 107-21-1	**Ethylene glycol** Acute Tox. 4: H302; STOT RE 2: H373 - Warning	**10 - <30 %**
CAS: Proprietary	**Anionic Surfactant** Eye Dam. 1: H318; Skin Irrit. 2: H315 - Danger	**10 - <30 %**

To obtain more information on the hazards of the substances consult sections 11, 12 and 16.

SECTION 4: FIRST AID MEASURES

4.1 Description of necessary first aid measures:

The symptoms resulting from intoxication can appear after exposure, therefore, in case of doubt, seek medical attention for direct exposure to the chemical product or persistent discomfort, showing the SDS of this product.

By inhalation:

This product does not contain substances classified as hazardous for inhalation, however, in case of symptoms of intoxication remove the person affected from the exposure area and provide with fresh air. Seek medical attention if the symptoms get worse or persist.

By skin contact:

Remove contaminated clothing and footwear, rinse skin or shower the person affected if appropriate with plenty of cold water and neutral soap. In serious cases see a doctor. If the product causes burns or freezing, clothing should not be removed as this could worsen the injury caused if it is stuck to the skin. If blisters form on the skin, these should never be burst as this will increase the risk of infection.

By eye contact:

Rinse eyes thoroughly with lukewarm water for at least 15 minutes. Do not allow the person affected to rub or close their eyes. If the injured person uses contact lenses, these should be removed unless they are stuck to the eyes, as this could cause further damage. In all cases, after cleaning, a doctor should be consulted as quickly as possible with the SDS of the product.

By ingestion/aspiration:

Do not induce vomiting, but if it does happen keep the head down to avoid aspiration. Keep the person affected at rest. Rinse out the mouth and throat, as they may have been affected during ingestion.

4.2 Symptoms caused by exposure:

Acute and delayed effects are indicated in sections 2 and 11.

4.3 Medical attention and special treatment:

Not available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable extinguishing equipment:

Suitable extinguishing media:

Product is non-flammable under normal conditions of storage, handling and use. In the case of combustion as a result of improper handling, storage or use preferably use polyvalent powder extinguishers (ABC powder), in accordance with the Regulation on fire protection systems.

Unsuitable extinguishing media:

Non-applicable

5.2 Specific hazards arising from the chemical:

- CONTINUED ON NEXT PAGE -

SECTION 5: FIREFIGHTING MEASURES (continued)

As a result of combustion or thermal decomposition reactive sub-products are created that can become highly toxic and, consequently, can present a serious health risk.

5.3 Special protective equipment and precautions for fire fighters:

Depending on the magnitude of the fire it may be necessary to use full protective clothing and individual respiratory equipment. Minimum emergency facilities and equipment should be available (fire blankets, portable first aid kit,...)

Additional provisions:

Act in accordance with the Internal Emergency Plan and the Information Sheets on actions to take after an accident or other emergencies. Destroy any source of ignition. In case of fire, refrigerate the storage containers and tanks for products susceptible to inflammation, explosion or BLEVE as a result of high temperatures. Avoid spillage of the products used to extinguish the fire into an aqueous medium.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures:

For non-emergency personnel:

Isolate leaks provided that there is no additional risk for the people performing this task. Personal protection equipment must be used against potential contact with the spilt product (See section 8). Evacuate the area and keep out those who do not have protection.

For emergency responders:

Wear protective equipment. Keep unprotected persons away. See section 8.

6.2 Environmental precautions:

This product is not classified as hazardous to the environment. Keep product away from drains, surface and underground water.

6.3 Methods and materials for containment and cleaning up:

It is recommended:

Absorb the spillage using sand or inert absorbent and move it to a safe place. Do not absorb in sawdust or other combustible absorbents. For any concern related to disposal consult section 13.

6.4 Reference to other sections:

See sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling:

A.- General precautions for safe use

Comply with the current legislation concerning the prevention of industrial risks with regards manually handling weights. Maintain order, cleanliness and dispose of using safe methods (section 6).

B.- Technical recommendations for the prevention of fires and explosions

Product is non-flammable under normal conditions of storage, manipulation and use. It is recommended to transfer at slow speeds to avoid the generation of electrostatic charges that can affect flammable products. Consult section 10 for information on conditions and materials that should be avoided.

C.- Technical recommendations on general occupational hygiene

Do not eat or drink during the process, washing hands afterwards with suitable cleaning products.

D.- Technical recommendations to prevent environmental risks

It is recommended to have absorbent material available at close proximity to the product (See subsection 6.3)

7.2 Conditions for safe storage, including any incompatibilities:

A.- Specific storage requirements

Minimum Temp.:	5 ºC
Maximum Temp.:	40 ºC
Maximum time:	12 Months

B.- General conditions for storage

Avoid sources of heat, radiation, static electricity and contact with food. For additional information see subsection 10.5

7.3 Specific end use(s):

- CONTINUED ON NEXT PAGE -

SECTION 7: HANDLING AND STORAGE (continued)

Except for the instructions already specified it is not necessary to provide any special recommendation regarding the uses of this product.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 Exposure control measures:

Substances whose occupational exposure limits have to be monitored in the workplace:

Workplace Exposure Standards for Airborne Contaminants 01/10/2022:

Identification	Occupational exposure limits		
Ethylene glycol [1]	TWA		10 mg/m³
CAS: 107-21-1	STEL		

[1] Skin

8.2 Engineering controls:

A.- Individual protection measures, for example personal protective equipment (PPE)

As a preventative measure it is recommended to use basic Personal Protection Equipment. For more information on Personal Protection Equipment (storage, use, cleaning, maintenance, class of protection,…) consult the information leaflet provided by the manufacturer. For more information see subsection 7.1.
All information contained herein is a recommendation which needs some specification from the labour risk prevention services as it is not known whether the company has additional measures at its disposal.

B.- Respiratory protection

The use of protection equipment will be necessary if a mist forms or if the occupational exposure limits are exceeded.

C.- Specific protection for the hands

Pictogram	PPE	Remarks
 Mandatory hand protection	Chemical protective gloves (Material: Linear low-density polyethylene (LLDPE), Breakthrough time: > 480 min, Thickness: 0.062 mm)	Replace the gloves at any sign of deterioration.

As the product is a mixture of several substances, the resistance of the glove material can not be calculated in advance with total reliability and has therefore to be checked prior to the application.

D.- Eye and face protection

Pictogram	PPE	Remarks
 Mandatory face protection	Panoramic glasses against splash/projections.	Clean daily and disinfect periodically according to the manufacturer´s instructions. Use if there is a risk of splashing.

E.- Bodily protection

Pictogram	PPE	Remarks
	Work clothing	Replace before any evidence of deterioration.
	Anti-slip work shoes	Replace before any evidence of deterioration.

F.- Additional emergency measures

Emergency measure	Standards	Emergency measure	Standards
 Emergency shower	ANSI Z358-1 ISO 3864-1:2011, ISO 3864-4:2011	 Eyewash stations	DIN 12 899 ISO 3864-1:2011, ISO 3864-4:2011

- CONTINUED ON NEXT PAGE -

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION (continued)

Environmental exposure controls:

In accordance with the community legislation for the protection of the environment it is recommended to avoid environmental spillage of both the product and its container. For additional information see subsection 7.1.D

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties:

For complete information see the product datasheet.

Appearance:

Physical state at 20 ºC:	Liquid
Appearance:	Transparent
Color:	Light yellow
Odor:	Characteristic
Odour threshold:	Not available *

Volatility:

Boiling point at atmospheric pressure:	>100 ºC
Vapour pressure at 20 ºC:	Not available *
Vapour pressure at 50 ºC:	Not available *
Evaporation rate at 20 ºC:	Not available *

Product description:

Density at 20 ºC:	Not available *
Relative density at 20 ºC:	>0.99 - 1.01
Dynamic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 40 ºC:	Not available *
Concentration:	Not available *
pH:	7 - 8.5
Vapour density at 20 ºC:	Not available *
Partition coefficient n-octanol/water 20 ºC:	Not available *
Solubility in water at 20 ºC:	Not available *
Solubility properties:	Water-soluble
Decomposition temperature:	Not available *
Melting point/freezing point:	-10 ºC

Flammability:

Flash Point:	>100 ºC
Flammability (solid, gas):	Not available *
Autoignition temperature:	Not available *
Lower flammability limit:	Not available *
Upper flammability limit:	Not available *

Particle characteristics:

Median equivalent diameter:	Non-applicable

9.2 Other information:

Information with regard to physical hazard classes:

Explosive properties:	Not available *
Oxidising properties:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

Corrosive to metals:	Not available *
Heat of combustion:	Not available *
Aerosols-total percentage (by mass) of flammable components:	Not available *

Other safety characteristics:

Surface tension at 20 ºC:	Not available *
Refraction index:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity:

No hazardous reactions are expected because the product is stable under recommended storage conditions. See section 7 from Safety Data Sheet.

10.2 Chemical stability:

Chemically stable under the indicated conditions of storage, handling and use.

10.3 Possibility of hazardous reactions:

Under the specified conditions, hazardous reactions that lead to excessive temperatures or pressure are not expected.

10.4 Conditions to avoid:

Applicable for handling and storage at room temperature:

Shock and friction	Contact with air	Increase in temperature	Sunlight	Humidity
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

10.5 Incompatible materials:

Acids	Water	Oxidising materials	Combustible materials	Others
Avoid strong acids	Not applicable	Not applicable	Not applicable	Avoid alkalis or strong bases

10.6 Hazardous decomposition products:

See subsection 10.3, 10.4 and 10.5 to find out the specific decomposition products. Depending on the decomposition conditions, complex mixtures of chemical substances can be released: carbon dioxide (CO_2), carbon monoxide and other organic compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects:

The experimental information related to the toxicological properties of the product itself is not available

Contains glycols. With possibility of effects that are hazardous to the health, it is recommended not to breathe the vapours for long periods of time.

Dangerous health implications:

In case of exposure that is repetitive, prolonged or at concentrations higher than recommended by the occupational exposure limits, it may result in adverse effects on health depending on the means of exposure:

A- Ingestion (acute effect):

- Acute toxicity: Based on available data, the classification criteria are not met, however, it contains substances classified as dangerous for consumption. For more information see section 3.
- Corrosivity/Irritability: The consumption of a considerable dose can cause irritation in the throat, abdominal pain, nausea and vomiting.

B- Inhalation (acute effect):

- Acute toxicity : Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for inhalation. For more information see section 3.
- Corrosivity/Irritability: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

C- Contact with the skin and the eyes (acute effect):

- CONTINUED ON NEXT PAGE -

SECTION 11: TOXICOLOGICAL INFORMATION (continued)

- Contact with the skin: Produces skin inflammation.
- Contact with the eyes: Produces serious eye damage after contact.

D- CMR effects (carcinogenicity, mutagenicity and toxicity to reproduction):

- Carcinogenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for the effects mentioned. For more information see section 3.
  IARC: Not available
- Mutagenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Reproductive toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

E- Sensitizing effects:

- Respiratory: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous with sensitising effects. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

F- Specific target organ toxicity (STOT) - single exposure:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

G- Specific target organ toxicity (STOT)-repeated exposure:

- Specific target organ toxicity (STOT)-repeated exposure: May cause damage to organs (kidney) through prolonged or repeated exposure (if swallowed).
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

H- Aspiration hazard:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

Other information:

Not available

Specific toxicology information on the substances:

Identification	Acute toxicity		Genus
Ethylene glycol	LD50 oral	500 mg/kg (ATEi)	
CAS: 107-21-1	LD50 dermal	>3500 mg/kg	Rabbit
	LC50 inhalation		

SECTION 12: ECOLOGICAL INFORMATION

The experimental information related to the eco-toxicological properties of the product itself is not available

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

12.1 Ecotoxicity:

Acute toxicity:

Identification	Concentration		Species	Genus
Ethylene glycol	LC50	53000 mg/L (96 h)	Pimephales promelas	Fish
CAS: 107-21-1	EC50	51000 mg/L (48 h)	Daphnia magna	Crustacean
	EC50	24000 mg/L (168 h)	Selenastrum capricornutum	Algae

- CONTINUED ON NEXT PAGE -

SECTION 12: ECOLOGICAL INFORMATION (continued)

12.2 Persistence and degradability:

Substance-specific information:

Identification	Degradability		Biodegradability	
Ethylene glycol	BOD5	0.47 g O2/g	Concentration	100 mg/L
CAS: 107-21-1	COD	1.29 g O2/g	Period	14 days
	BOD5/COD	0.36	% Biodegradable	90 %

12.3 Bioaccumulative potential:

Substance-specific information:

Identification	Bioaccumulation potential	
Ethylene glycol	BCF	10
CAS: 107-21-1	Pow Log	-1.36
	Potential	Low

12.4 Mobility in soil:

Identification	Absorption/desorption		Volatility	
Ethylene glycol	Koc	0	Henry	1.327E-1 Pa·m³/mol
CAS: 107-21-1	Conclusion	Very High	Dry soil	No
	Surface tension	4.989E-2 N/m (25 ºC)	Moist soil	No

12.5 Results of PBT and vPvB assessment:

Non-applicable

12.6 Other adverse effects:

Not described

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Disposal methods:

Waste management (disposal and evaluation):

Consult the authorized waste service manager on the assessment and disposal operations. In case the container has been in direct contact with the product, it will be processed the same way as the actual product. Otherwise, it will be processed as non-hazardous residue. Waste should not be disposed of to drains. See epigraph 6.2.

Regulations related to waste management:

Legislation related to waste management:

Basel Convention (Hazardous Waste)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 and Amendments

SECTION 14: TRANSPORT INFORMATION

This product is not regulated for transport.

- CONTINUED ON NEXT PAGE -

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations:

Specific provisions in terms of protecting people or the environment:

It is recommended to use the information included in this safety data sheet as data used in a risk evaluation of the local circumstances in order to establish the necessary risk prevention measures for the manipulation, use, storage and disposal of this product.

Industrial Chemicals Act 2019:

Industrial Chemicals (Notification and Assessment) Act 1989

SECTION 16: OTHER INFORMATION

Legislation related to safety data sheets:

This safety data sheet has been designed in accordance with WHS regulations and Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Texts of the legislative phrases mentioned in section 2:

H373: May cause damage to organs through prolonged or repeated exposure (Oral).
H315: Causes skin irritation.
H318: Causes serious eye damage.

Texts of the legislative phrases mentioned in section 3:

The phrases indicated do not refer to the product itself; they are present merely for informative purposes and refer to the individual components which appear in section 3

WHS:

Acute Tox. 4: H302 - Harmful if swallowed.
Eye Dam. 1: H318 - Causes serious eye damage.
Skin Irrit. 2: H315 - Causes skin irritation.
STOT RE 2: H373 - May cause damage to organs through prolonged or repeated exposure (Oral).

Advice related to training:

Minimal training is recommended to prevent industrial risks for staff using this product, in order to facilitate their comprehension and interpretation of this safety data sheet, as well as the label on the product.

Principal bibliographical sources:

http://www.safeworkaustralia.gov.au/

Abbreviations and acronyms:

ADG: Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG: International maritime dangerous goods code
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
COD: Chemical Oxygen Demand
BOD5: 5-day biochemical oxygen demand
BCF: Bioconcentration factor
LD50: Lethal Dose 50
CL50: Lethal Concentration 50
EC50: Effective concentration 50
Log-POW: Octanol-water partition coefficient
Koc: Partition coefficient of organic carbon
IARC: International Agency for Research on Cancer

END OF SAFETY DATA SHEET

SODA ASH

SECTION 1: IDENTIFICATION

1.1 Product identifier: SODA ASH

Sodium carbonate

CAS: 497-19-8

Other means of identification:

Not available

1.2 Recommended use of the chemical and restrictions on use:

Relevant uses: Buffer. For professional users only.

Uses advised against: All uses not specified in this section or in section 7.3

1.3 Details of manufacturer or importer:

Fusion Technologies (Australia) Pty
Unit 3, 1472 Boundary Road
Wacol, Queensland 4076, Australia
Phone: +61 460 047 656
https://www.fusiontechinc.net/

Technical Inquries: help@fusiontechinc.net

1.4 Emergency phone number: **AU 1800 033 111 NZ 0800 734 607 (ALL HOURS)**

SECTION 2: HAZARD(S) IDENTIFICATION

2.1 Classification of the hazardous chemical:

WHS:

Classification of this product has been carried out in accordance with Model Work Health and Safety Regulations(Hazardous Chemicals) Amendment 2022

Eye Irrit. 2A: Eye irritation, Category 2A, H319

2.2 Label elements, including precautionary statements:

WHS:

Warning

Hazard statements:

Eye Irrit. 2A: H319 - Causes serious eye irritation.

Precautionary statements:

P264: Wash thoroughly after use.
P280: Wear protective gloves/protective clothing/respiratory protection/eye protection/protective footwear.
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.

2.3 Other hazards which do not result in classification:

Not available

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

3.1 Substances:

Chemical description: Chemical substance

In accordance with Schedule 8 (WHS Regulations), the product contains:

Identification	Chemical name/Classification	Concentration
CAS: 497-19-8	**Sodium carbonate** Eye Irrit. 2A: H319 - Warning	**100 %**

To obtain more information on the hazards of the substances consult sections 11, 12 and 16.

- CONTINUED ON NEXT PAGE -

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8 (continued)

3.2 Mixtures:

Non-applicable

SECTION 4: FIRST AID MEASURES

4.1 Description of necessary first aid measures:

The symptoms resulting from intoxication can appear after exposure, therefore, in case of doubt, seek medical attention for direct exposure to the chemical product or persistent discomfort, showing the SDS of this product.

By inhalation:

This product does not contain substances classified as hazardous for inhalation, however, in case of symptoms of intoxication remove the person affected from the exposure area and provide with fresh air. Seek medical attention if the symptoms get worse or persist.

By skin contact:

In case of contact it is recommended to clean the affected area thoroughly with water and neutral soap. In case of changes to the skin (stinging, redness, rashes, blisters,…), seek medical advice with this Safety Data Sheet

By eye contact:

Rinse eyes thoroughly with lukewarm water for at least 15 minutes. Do not allow the person affected to rub or close their eyes. If the injured person uses contact lenses, these should be removed unless they are stuck to the eyes, as this could cause further damage. In all cases, after cleaning, a doctor should be consulted as quickly as possible with the SDS of the product.

By ingestion/aspiration:

In case of consumption, seek immediate medical assistance showing the SDS of this product.

4.2 Symptoms caused by exposure:

Acute and delayed effects are indicated in sections 2 and 11.

4.3 Medical attention and special treatment:

Not available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable extinguishing equipment:

Suitable extinguishing media:

Product is non-flammable under normal conditions of storage, handling and use. In the case of combustion as a result of improper handling, storage or use preferably use polyvalent powder extinguishers (ABC powder), in accordance with the Regulation on fire protection systems.

Unsuitable extinguishing media:

Non-applicable

5.2 Specific hazards arising from the chemical:

As a result of combustion or thermal decomposition reactive sub-products are created that can become highly toxic and, consequently, can present a serious health risk.

5.3 Special protective equipment and precautions for fire fighters:

Depending on the magnitude of the fire it may be necessary to use full protective clothing and individual respiratory equipment. Minimum emergency facilities and equipment should be available (fire blankets, portable first aid kit,...)

Additional provisions:

Act in accordance with the Internal Emergency Plan and the Information Sheets on actions to take after an accident or other emergencies. Destroy any source of ignition. In case of fire, refrigerate the storage containers and tanks for products susceptible to inflammation, explosion or BLEVE as a result of high temperatures. Avoid spillage of the products used to extinguish the fire into an aqueous medium.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures:

For non-emergency personnel:

Sweep up and shovel product or other means and place in container for reuse (preferred) or disposal

- CONTINUED ON NEXT PAGE -

SECTION 6: ACCIDENTAL RELEASE MEASURES (continued)

For emergency responders:

Wear protective equipment. Keep unprotected persons away. See section 8.

6.2 Environmental precautions:

This product is not classified as hazardous to the environment. Keep product away from drains, surface and underground water.

6.3 Methods and materials for containment and cleaning up:

It is recommended:

Sweep up and shovel product or other means and place in container for reuse (preferred) or disposal

6.4 Reference to other sections:

See sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling:

A.- General precautions for safe use

Comply with the current legislation concerning the prevention of industrial risks with regards manually handling weights. Maintain order, cleanliness and dispose of using safe methods (section 6).

B.- Technical recommendations for the prevention of fires and explosions

Due to its non-flammable nature, the product does not present a fire risk under normal conditions of storage, manipulation and use.

C.- Technical recommendations on general occupational hygiene

Do not eat or drink during the process, washing hands afterwards with suitable cleaning products.

D.- Technical recommendations to prevent environmental risks

It is recommended to have absorbent material available at close proximity to the product (See subsection 6.3)

7.2 Conditions for safe storage, including any incompatibilities:

A.- Specific storage requirements

Minimum Temp.:	5 ºC
Maximum Temp.:	40 ºC
Maximum time:	6 Months

B.- General conditions for storage

Avoid sources of heat, radiation, static electricity and contact with food. For additional information see subsection 10.5

7.3 Specific end use(s):

Except for the instructions already specified it is not necessary to provide any special recommendation regarding the uses of this product.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 Exposure control measures:

Substances whose occupational exposure limits have to be monitored in the workplace:

Nuisance dust: Inhalable dust 10 mg/m3 // Respirable dust 4 mg/m3

8.2 Engineering controls:

A.- Individual protection measures, for example personal protective equipment (PPE)

As a preventative measure it is recommended to use basic Personal Protection Equipment. For more information on Personal Protection Equipment (storage, use, cleaning, maintenance, class of protection,…) consult the information leaflet provided by the manufacturer. For more information see subsection 7.1.
All information contained herein is a recommendation which needs some specification from the labour risk prevention services as it is not known whether the company has additional measures at its disposal.

B.- Respiratory protection

- CONTINUED ON NEXT PAGE -

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION (continued)

Pictogram	PPE	Remarks
 Compulsory use of face mask	Filter mask for particles	Replace when an increase in resistence to breathing is observed.

C.- Specific protection for the hands

Pictogram	PPE	Remarks
 Mandatory hand protection	Protective gloves against minor risks	Replace gloves in case of any sign of damage. For prolonged periods of exposure to the product for professional users/industrials, we recommend using chemical protection gloves

D.- Eye and face protection

Pictogram	PPE	Remarks
 Mandatory face protection	Panoramic glasses against splash/projections.	Clean daily and disinfect periodically according to the manufacturer´s instructions. Use if there is a risk of splashing.

E.- Bodily protection

Pictogram	PPE	Remarks
	Work clothing	Replace before any evidence of deterioration.
	Anti-slip work shoes	Replace before any evidence of deterioration.

F.- Additional emergency measures

Emergency measure	Standards	Emergency measure	Standards
 Emergency shower	ANSI Z358-1 ISO 3864-1:2011, ISO 3864-4:2011	 Eyewash stations	DIN 12 899 ISO 3864-1:2011, ISO 3864-4:2011

Environmental exposure controls:

In accordance with the community legislation for the protection of the environment it is recommended to avoid environmental spillage of both the product and its container. For additional information see subsection 7.1.D

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties:

For complete information see the product datasheet.

Appearance:

Physical state at 20 ºC:	Solid
Appearance:	Powdery
Color:	☐ White
Odor:	Odourless
Odour threshold:	Not available *

Volatility:

Boiling point at atmospheric pressure:	1600 ºC

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

Vapour pressure at 20 ºC:	Not available *
Vapour pressure at 50 ºC:	Not available *
Evaporation rate at 20 ºC:	Not available *
Product description:	
Bulk Density:	500 – 800 kg/m^3
Relative density at 20 ºC:	2.53
Dynamic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 40 ºC:	Not available *
Concentration:	Not available *
pH:	11.3 (at 1 %)
Vapour density at 20 ºC:	Not available *
Partition coefficient n-octanol/water 20 ºC:	Not available *
Solubility in water at 20 ºC:	Not available *
Solubility properties:	Water-soluble
Decomposition temperature:	Not available *
Melting point/freezing point:	851 ºC
Flammability:	
Flash Point:	Non-applicable
Flammability (solid, gas):	Not available *
Autoignition temperature:	Not available *
Lower flammability limit:	Not available *
Upper flammability limit:	Not available *
Explosive (Solid):	
Lower explosive limit:	Not available *
Upper explosive limit:	Not available *
Particle characteristics:	
Median equivalent diameter:	Not available *

9.2 Other information:

Information with regard to physical hazard classes:

Explosive properties:	Not available *
Oxidising properties:	Not available *
Corrosive to metals:	Not available *
Heat of combustion:	Not available *
Aerosols-total percentage (by mass) of flammable components:	Not available *
Other safety characteristics:	
Surface tension at 20 ºC:	Not available *
Refraction index:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity:

No hazardous reactions are expected because the product is stable under recommended storage conditions. See section 7 from Safety Data Sheet.

10.2 Chemical stability:

- CONTINUED ON NEXT PAGE -

SECTION 10: STABILITY AND REACTIVITY (continued)

Chemically stable under the indicated conditions of storage, handling and use.

10.3 Possibility of hazardous reactions:

Under the specified conditions, hazardous reactions that lead to excessive temperatures or pressure are not expected.

10.4 Conditions to avoid:

Applicable for handling and storage at room temperature:

Shock and friction	Contact with air	Increase in temperature	Sunlight	Humidity
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

10.5 Incompatible materials:

Acids	Water	Oxidising materials	Combustible materials	Others
Avoid strong acids	Not applicable	Not applicable	Not applicable	Avoid alkalis or strong bases

10.6 Hazardous decomposition products:

See subsection 10.3, 10.4 and 10.5 to find out the specific decomposition products. Depending on the decomposition conditions, complex mixtures of chemical substances can be released: carbon dioxide (CO_2), carbon monoxide and other organic compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects:

Dangerous health implications:

In case of exposure that is repetitive, prolonged or at concentrations higher than recommended by the occupational exposure limits, it may result in adverse effects on health depending on the means of exposure:

A- Ingestion (acute effect):

- Acute toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for consumption. For more information see section 3
- Corrosivity/Irritability: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

B- Inhalation (acute effect):

- Acute toxicity : Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for inhalation. For more information see section 3.
- Corrosivity/Irritability: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

C- Contact with the skin and the eyes (acute effect):

- Contact with the skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for skin contact. For more information see section 3.
- Contact with the eyes: Produces eye damage after contact.

D- CMR effects (carcinogenicity, mutagenicity and toxicity to reproduction):

- Carcinogenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for the effects mentioned. For more information see section 3.
  IARC: Not available
- Mutagenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Reproductive toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

E- Sensitizing effects:

- Respiratory: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous with sensitising effects. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

F- Specific target organ toxicity (STOT) - single exposure:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

G- Specific target organ toxicity (STOT)-repeated exposure:

- Specific target organ toxicity (STOT)-repeated exposure: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

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SECTION 11: TOXICOLOGICAL INFORMATION (continued)

H- Aspiration hazard:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

Other information:

Not available

Product-specific toxicological information:

Acute toxicity		Genus
LD50 oral	2800 mg/kg	Rat

Specific toxicology information on the substances:

Identification	Acute toxicity		Genus
Sodium carbonate CAS: 497-19-8	LD50 oral	2800 mg/kg	Rat
	LD50 dermal		
	LC50 inhalation		

SECTION 12: ECOLOGICAL INFORMATION

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

12.1 Ecotoxicity:

Product-specific aquatic toxicity:

Acute toxicity		Species	Genus
LC50	740 mg/L (96 h)	Non-applicable	Fish
EC50	265 mg/L (48 h)	Non-applicable	Crustacean

Substance-specific aquatic toxicity:

Acute toxicity:

Identification	Concentration		Species	Genus
Sodium carbonate CAS: 497-19-8	LC50	740 mg/L (96 h)	Gambussia afinis	Fish
	EC50	265 mg/L (48 h)	Daphnia magna	Crustacean
	EC50	Not available		

12.2 Persistence and degradability:

Not available

12.3 Bioaccumulative potential:

Not available

12.4 Mobility in soil:

Not available

Partially water-soluble

12.5 Results of PBT and vPvB assessment:

Non-applicable

12.6 Other adverse effects:

Not described

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Disposal methods:

Waste management (disposal and evaluation):

Consult the authorized waste service manager on the assessment and disposal operations. In case the container has been in direct contact with the product, it will be processed the same way as the actual product. Otherwise, it will be processed as non-hazardous residue. Waste should not be disposed of to drains. See epigraph 6.2.

Regulations related to waste management:

- CONTINUED ON NEXT PAGE -

SECTION 13: DISPOSAL CONSIDERATIONS (continued)

Legislation related to waste management:

Basel Convention (Hazardous Waste)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 and Amendments

SECTION 14: TRANSPORT INFORMATION

This product is not regulated for transport.

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations:

Specific provisions in terms of protecting people or the environment:

It is recommended to use the information included in this safety data sheet as data used in a risk evaluation of the local circumstances in order to establish the necessary risk prevention measures for the manipulation, use, storage and disposal of this product.

Industrial Chemicals Act 2019:

Industrial Chemicals (Notification and Assessment) Act 1989

SECTION 16: OTHER INFORMATION

Legislation related to safety data sheets:
This safety data sheet has been designed in accordance with WHS regulations and Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Texts of the legislative phrases mentioned in section 2:
H319: Causes serious eye irritation.

Texts of the legislative phrases mentioned in section 3:
The phrases indicated do not refer to the product itself; they are present merely for informative purposes and refer to the individual components which appear in section 3

WHS:
Eye Irrit. 2A: H319 - Causes serious eye irritation.

Advice related to training:
Minimal training is recommended to prevent industrial risks for staff using this product, in order to facilitate their comprehension and interpretation of this safety data sheet, as well as the label on the product.

Principal bibliographical sources:
http://www.safeworkaustralia.gov.au/

Abbreviations and acronyms:
ADG: Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG: International maritime dangerous goods code
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
COD: Chemical Oxygen Demand
BOD5: 5-day biochemical oxygen demand
BCF: Bioconcentration factor
LD50: Lethal Dose 50
CL50: Lethal Concentration 50
EC50: Effective concentration 50
Log-POW: Octanol-water partition coefficient
Koc: Partition coefficient of organic carbon
IARC: International Agency for Research on Cancer

END OF SAFETY DATA SHEET

SECTION 1: IDENTIFICATION

1.1 Product identifier: XLB-C1F

Other means of identification:

Not available

1.2 Recommended use of the chemical and restrictions on use:

Relevant uses: Gelling agent . For professional users only.

Uses advised against: All uses not specified in this section or in section 7.3

1.3 Details of manufacturer or importer:

Fusion Technologies (Australia) Pty
Unit 3, 1472 Boundary Road
Wacol, Queensland 4076, Australia
Phone: +61 460 047 656
https://www.fusiontechinc.net/

Technical Inquries: help@fusiontechinc.net

1.4 Emergency phone number: **AU 1800 033 111 NZ 0800 734 607 (ALL HOURS)**

SECTION 2: HAZARD(S) IDENTIFICATION

2.1 Classification of the hazardous chemical:

WHS:

Classification of this product has been carried out in accordance with Model Work Health and Safety Regulations(Hazardous Chemicals) Amendment 2022

Eye Dam. 1: Serious eye damage, Category 1, H318
Met. Corr. 1: Corrosive to metals, Category 1, H290
Skin Corr. 1A: Skin corrosion, Category 1A, H314

2.2 Label elements, including precautionary statements:

WHS:

Danger

Hazard statements:

Met. Corr. 1: H290 - May be corrosive to metals.
Skin Corr. 1A: H314 - Causes severe skin burns and eye damage.

Precautionary statements:

P234: Keep only in original container.
P264: Wash thoroughly after use.
P280: Wear protective gloves/face protection/protective clothing/protective footwear.
P301+P330+P331: IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P303+P361+P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
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.

Substances that contribute to the classification

Sodium hydroxide (<10 %)

2.3 Other hazards which do not result in classification:

Not available

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

3.1 Substances:

Non-applicable

3.2 Mixtures:

Chemical description: Mixture of substances

- CONTINUED ON NEXT PAGE -

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8 (continued)

Components:

In accordance with Schedule 8 (WHS Regulations), the product contains:

Identification	Chemical name/Classification	Concentration
CAS: 1310-73-2	**Sodium hydroxide** Eye Dam. 1: H318; Met. Corr. 1: H290; Skin Corr. 1A: H314 - Danger	**<10 %**
CAS: 497-19-8	**Sodium carbonate** Eye Irrit. 2A: H319 - Warning	**<10 %**

To obtain more information on the hazards of the substances consult sections 11, 12 and 16.

SECTION 4: FIRST AID MEASURES

4.1 Description of necessary first aid measures:

Request medical assistance immediately, showing the SDS of this product.

By inhalation:

This product does not contain substances classified as hazardous for inhalation, however, in case of symptoms of intoxication remove the person affected from the exposure area and provide with fresh air. Seek medical attention if the symptoms get worse or persist.

By skin contact:

Remove contaminated clothing and footwear, rinse skin or shower the person affected if appropriate with plenty of cold water and neutral soap. In serious cases see a doctor. If the product causes burns or freezing, clothing should not be removed as this could worsen the injury caused if it is stuck to the skin. If blisters form on the skin, these should never be burst as this will increase the risk of infection.

By eye contact:

Rinse eyes thoroughly with lukewarm water for at least 15 minutes. Do not allow the person affected to rub or close their eyes. If the injured person uses contact lenses, these should be removed unless they are stuck to the eyes, as this could cause further damage. In all cases, after cleaning, a doctor should be consulted as quickly as possible with the SDS of the product.

By ingestion/aspiration:

Request immediate medical assistance, showing the SDS of this product. Do not induce vomiting, because its expulsion from the stomach can be hazardous to the mucus of the main digestive tract, and its inhalation, to the respiratory system. Rinse out the mouth and throat, as they may have been affected during ingestion. In the case of loss of consciousness do not administrate anything orally unless supervised by a doctor. Keep the person affected at rest.

4.2 Symptoms caused by exposure:

Acute and delayed effects are indicated in sections 2 and 11.

4.3 Medical attention and special treatment:

Not available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable extinguishing equipment:

Suitable extinguishing media:

Product is non-flammable under normal conditions of storage, handling and use. In the case of combustion as a result of improper handling, storage or use preferably use polyvalent powder extinguishers (ABC powder), in accordance with the Regulation on fire protection systems.

Unsuitable extinguishing media:

Non-applicable

5.2 Specific hazards arising from the chemical:

As a result of combustion or thermal decomposition reactive sub-products are created that can become highly toxic and, consequently, can present a serious health risk.

5.3 Special protective equipment and precautions for fire fighters:

Depending on the magnitude of the fire it may be necessary to use full protective clothing and individual respiratory equipment. Minimum emergency facilities and equipment should be available (fire blankets, portable first aid kit,...)

- CONTINUED ON NEXT PAGE -

SECTION 5: FIREFIGHTING MEASURES (continued)

Additional provisions:

Act in accordance with the Internal Emergency Plan and the Information Sheets on actions to take after an accident or other emergencies. Destroy any source of ignition. In case of fire, refrigerate the storage containers and tanks for products susceptible to inflammation, explosion or BLEVE as a result of high temperatures. Avoid spillage of the products used to extinguish the fire into an aqueous medium.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures:

For non-emergency personnel:

Isolate leaks provided that there is no additional risk for the people performing this task. Personal protection equipment must be used against potential contact with the spilt product (See section 8). Evacuate the area and keep out those who do not have protection.

For emergency responders:

Wear protective equipment. Keep unprotected persons away. See section 8.

6.2 Environmental precautions:

This product is not classified as hazardous to the environment. Keep product away from drains, surface and underground water.

6.3 Methods and materials for containment and cleaning up:

It is recommended:

Absorb the spillage using sand or inert absorbent and move it to a safe place. Do not absorb in sawdust or other combustible absorbents. For any concern related to disposal consult section 13.

6.4 Reference to other sections:

See sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling:

A.- General precautions for safe use

Comply with the current legislation concerning the prevention of industrial risks. Control spills and residues, destroying them with safe methods (section 6). Avoid leakages from the container. Maintain order and cleanliness where dangerous products are used. KEEP ONLY IN ORIGINAL CONTAINER.

B.- Technical recommendations for the prevention of fires and explosions

Product is non-flammable under normal conditions of storage, manipulation and use. It is recommended to transfer at slow speeds to avoid the generation of electrostatic charges that can affect flammable products. Consult section 10 for information on conditions and materials that should be avoided.

C.- Technical recommendations on general occupational hygiene

Do not eat or drink during the process, washing hands afterwards with suitable cleaning products.

D.- Technical recommendations to prevent environmental risks

It is recommended to have absorbent material available at close proximity to the product (See subsection 6.3)

7.2 Conditions for safe storage, including any incompatibilities:

A.- Specific storage requirements

Minimum Temp.:	5 ºC
Maximum Temp.:	40 ºC
Maximum time:	6 Months

B.- General conditions for storage

Avoid sources of heat, radiation, static electricity and contact with food. For additional information see subsection 10.5

7.3 Specific end use(s):

Except for the instructions already specified it is not necessary to provide any special recommendation regarding the uses of this product.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

- CONTINUED ON NEXT PAGE -

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION (continued)

8.1 Exposure control measures:

Substances whose occupational exposure limits have to be monitored in the workplace:

Workplace Exposure Standards for Airborne Contaminants 01/10/2022:

Identification	Occupational exposure limits		
Sodium hydroxide	TWA		2 mg/m³
CAS: 1310-73-2	STEL		

8.2 Engineering controls:

A.- Individual protection measures, for example personal protective equipment (PPE)

As a preventative measure it is recommended to use basic Personal Protection Equipment. For more information on Personal Protection Equipment (storage, use, cleaning, maintenance, class of protection,…) consult the information leaflet provided by the manufacturer. For more information see subsection 7.1.
All information contained herein is a recommendation which needs some specification from the labour risk prevention services as it is not known whether the company has additional measures at its disposal.

B.- Respiratory protection

The use of protection equipment will be necessary if a mist forms or if the occupational exposure limits are exceeded.

C.- Specific protection for the hands

Pictogram	PPE	Remarks
 Mandatory hand protection	Chemical protective gloves (Material: Linear low-density polyethylene (LLDPE), Breakthrough time: > 480 min, Thickness: 0.062 mm)	Replace the gloves at any sign of deterioration.

As the product is a mixture of several substances, the resistance of the glove material can not be calculated in advance with total reliability and has therefore to be checked prior to the application.

D.- Eye and face protection

Pictogram	PPE	Remarks
 Mandatory face protection	Face shield	Clean daily and disinfect periodically according to the manufacturer´s instructions. Use if there is a risk of splashing.

E.- Bodily protection

Pictogram	PPE	Remarks
 Mandatory complete body protection	Disposable clothing for protection against chemical risks	For professional use only. Clean periodically according to the manufacturer´s instructions.
 Mandatory foot protection	Safety footwear for protection against chemical risk	Replace boots at any sign of deterioration.

F.- Additional emergency measures

Emergency measure	Standards	Emergency measure	Standards
 Emergency shower	ANSI Z358-1 ISO 3864-1:2011, ISO 3864-4:2011	 Eyewash stations	DIN 12 899 ISO 3864-1:2011, ISO 3864-4:2011

Environmental exposure controls:

In accordance with the community legislation for the protection of the environment it is recommended to avoid environmental spillage of both the product and its container. For additional information see subsection 7.1.D

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SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties:

For complete information see the product datasheet.

Appearance:

Physical state at 20 ºC:	Liquid
Appearance:	Colorless
Color:	Colourless
Odor:	Not available
Odour threshold:	Not available *

Volatility:

Boiling point at atmospheric pressure:	100 ºC
Vapour pressure at 20 ºC:	2350 Pa
Vapour pressure at 50 ºC:	12381.01 Pa (12.38 kPa)
Evaporation rate at 20 ºC:	Not available *

Product description:

Density at 20 ºC:	Not available *
Relative density at 20 ºC:	1.15
Dynamic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 40 ºC:	Not available *
Concentration:	Not available *
pH:	13
Vapour density at 20 ºC:	Not available *
Partition coefficient n-octanol/water 20 ºC:	Not available *
Solubility in water at 20 ºC:	Not available *
Solubility properties:	Not available *
Decomposition temperature:	Not available *
Melting point/freezing point:	-6 ºC

Flammability:

Flash Point:	Non Flammable (>93 ºC)
Flammability (solid, gas):	Not available *
Autoignition temperature:	Not available *
Lower flammability limit:	Not available *
Upper flammability limit:	Not available *

Particle characteristics:

Median equivalent diameter:	Non-applicable

9.2 Other information:

Information with regard to physical hazard classes:

Explosive properties:	Not available *
Oxidising properties:	Not available *
Corrosive to metals:	H290 May be corrosive to metals.
Heat of combustion:	Not available *
Aerosols-total percentage (by mass) of flammable components:	Not available *

Other safety characteristics:

Surface tension at 20 ºC:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

Refraction index: Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity:

No hazardous reactions are expected because the product is stable under recommended storage conditions. See section 7 from Safety Data Sheet.

10.2 Chemical stability:

Chemically stable under the indicated conditions of storage, handling and use.

10.3 Possibility of hazardous reactions:

Under the specified conditions, hazardous reactions that lead to excessive temperatures or pressure are not expected.

10.4 Conditions to avoid:

Applicable for handling and storage at room temperature:

Shock and friction	Contact with air	Increase in temperature	Sunlight	Humidity
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

10.5 Incompatible materials:

Acids	Water	Oxidising materials	Combustible materials	Others
Avoid strong acids	Not applicable	Precaution	Not applicable	Not applicable

10.6 Hazardous decomposition products:

See subsection 10.3, 10.4 and 10.5 to find out the specific decomposition products. Depending on the decomposition conditions, complex mixtures of chemical substances can be released: carbon dioxide (CO_2), carbon monoxide and other organic compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects:

The experimental information related to the toxicological properties of the product itself is not available

Dangerous health implications:

In case of exposure that is repetitive, prolonged or at concentrations higher than recommended by the occupational exposure limits, it may result in adverse effects on health depending on the means of exposure:

A- Ingestion (acute effect):

- Acute toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for consumption. For more information see section 3
- Corrosivity/Irritability: Corrosive product, if it is swallowed causes burns destroying the tissues. For more information about secondary effects from skin contact see section 2.

B- Inhalation (acute effect):

- Acute toxicity : Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for inhalation. For more information see section 3.
- Corrosivity/Irritability: Prolonged inhalation of the product is corrosive to mucous membranes and the upper respiratory tract

C- Contact with the skin and the eyes (acute effect):

- Contact with the skin: Above all, skin contact may occur as fabrics of all thicknesses can be destroyed, resulting in burns. For more information on the secondary effects see section 2.
- Contact with the eyes: Produces serious eye damage after contact.

D- CMR effects (carcinogenicity, mutagenicity and toxicity to reproduction):

- Carcinogenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for the effects mentioned. For more information see section 3.
  IARC: Not available
- Mutagenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Reproductive toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

E- Sensitizing effects:

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SECTION 11: TOXICOLOGICAL INFORMATION (continued)

- Respiratory: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous with sensitising effects. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

F- Specific target organ toxicity (STOT) - single exposure:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

G- Specific target organ toxicity (STOT)-repeated exposure:

- Specific target organ toxicity (STOT)-repeated exposure: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

H- Aspiration hazard:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

Other information:

Not available

Specific toxicology information on the substances:

Identification	Acute toxicity		Genus
Sodium carbonate	LD50 oral	2800 mg/kg	Rat
CAS: 497-19-8	LD50 dermal		
	LC50 inhalation		

SECTION 12: ECOLOGICAL INFORMATION

The experimental information related to the eco-toxicological properties of the product itself is not available

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

12.1 Ecotoxicity:

Acute toxicity:

Identification	Concentration		Species	Genus
Sodium hydroxide	LC50	189 mg/L (48 h)	Leuciscus idus	Fish
CAS: 1310-73-2	EC50	33 mg/L	Crangon crangon	Crustacean
	EC50	Not available		
Sodium carbonate	LC50	740 mg/L (96 h)	Gambussia afinis	Fish
CAS: 497-19-8	EC50	265 mg/L (48 h)	Daphnia magna	Crustacean
	EC50	Not available		

12.2 Persistence and degradability:

Not available

12.3 Bioaccumulative potential:

Not available

12.4 Mobility in soil:

Not available

12.5 Results of PBT and vPvB assessment:

Non-applicable

12.6 Other adverse effects:

Not described

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Disposal methods:

- CONTINUED ON NEXT PAGE -

SECTION 13: DISPOSAL CONSIDERATIONS (continued)

Waste management (disposal and evaluation):

Consult the authorized waste service manager on the assessment and disposal operations. In case the container has been in direct contact with the product, it will be processed the same way as the actual product. Otherwise, it will be processed as non-hazardous residue. Waste should not be disposed of to drains. See epigraph 6.2.

Regulations related to waste management:

Legislation related to waste management:

Basel Convention (Hazardous Waste)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 and Amendments

SECTION 14: TRANSPORT INFORMATION

Transport of dangerous goods by land:

With regard to ADG Code:

14.1	**UN number:**	UN3267
14.2	**Proper shipping name or Technical Name:**	CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S. (Sodium hydroxide)
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	II
14.5	**Environmental hazards for Transport Purposes:**	No
14.6	**Special precautions for user**	
	Physico-Chemical properties:	see section 9
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

Transport of dangerous goods by sea:

With regard to IMDG 41-22:

14.1	**UN number:**	UN3267
14.2	**Proper shipping name or Technical Name:**	CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S. (Sodium hydroxide)
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	II
14.5	**Marine pollutant:**	No
14.6	**Special precautions for user**	
	Special regulations:	274
	EmS Codes:	F-A, S-B
	Physico-Chemical properties:	see section 9
	Limited quantities:	1 L
	Segregation group:	SGG18
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

Transport of dangerous goods by air:

With regard to IATA/ICAO 2024:

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SECTION 14: TRANSPORT INFORMATION (continued)

14.1	**UN number:**	UN3267
14.2	**Proper shipping name or Technical Name:**	CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S. (Sodium hydroxide)
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	II
14.5	**Environmental hazards for Transport Purposes:**	No
14.6	**Special precautions for user**	
	Physico-Chemical properties:	see section 9
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations:

Specific provisions in terms of protecting people or the environment:

It is recommended to use the information included in this safety data sheet as data used in a risk evaluation of the local circumstances in order to establish the necessary risk prevention measures for the manipulation, use, storage and disposal of this product.

Industrial Chemicals Act 2019:

Industrial Chemicals (Notification and Assessment) Act 1989

SECTION 16: OTHER INFORMATION

Legislation related to safety data sheets:

This safety data sheet has been designed in accordance with WHS regulations and Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Texts of the legislative phrases mentioned in section 2:

H290: May be corrosive to metals.
H318: Causes serious eye damage.
H314: Causes severe skin burns and eye damage.

Texts of the legislative phrases mentioned in section 3:

The phrases indicated do not refer to the product itself; they are present merely for informative purposes and refer to the individual components which appear in section 3

WHS:

Eye Dam. 1: H318 - Causes serious eye damage.
Eye Irrit. 2A: H319 - Causes serious eye irritation.
Met. Corr. 1: H290 - May be corrosive to metals.
Skin Corr. 1A: H314 - Causes severe skin burns and eye damage.

Advice related to training:

Minimal training is recommended to prevent industrial risks for staff using this product, in order to facilitate their comprehension and interpretation of this safety data sheet, as well as the label on the product.

Principal bibliographical sources:

http://www.safeworkaustralia.gov.au/

Abbreviations and acronyms:

ADG: Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG: International maritime dangerous goods code
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
COD: Chemical Oxygen Demand
BOD5: 5-day biochemical oxygen demand
BCF: Bioconcentration factor
LD50: Lethal Dose 50
CL50: Lethal Concentration 50
EC50: Effective concentration 50
Log-POW: Octanol-water partition coefficient
Koc: Partition coefficient of organic carbon
IARC: International Agency for Research on Cancer

- CONTINUED ON NEXT PAGE -

END OF SAFETY DATA SHEET

SECTION 1: IDENTIFICATION

1.1 Product identifier: AI-CI-1F

Other means of identification:

Not available

1.2 Recommended use of the chemical and restrictions on use:

Relevant uses: Corrosion inhibitor. For professional users only.

Uses advised against: All uses not specified in this section or in section 7.3

1.3 Details of manufacturer or importer:

Fusion Technologies (Australia) Pty
Unit 3, 1472 Boundary Road
Wacol, Queensland 4076, Australia
Phone: +61 460 047 656
https://www.fusiontechinc.net/

Technical Inquries: help@fusiontechinc.net

1.4 Emergency phone number: **AU 1800 033 111 NZ 0800 734 607 (ALL HOURS)**

SECTION 2: HAZARD(S) IDENTIFICATION

2.1 Classification of the hazardous chemical:

Product classified regardless of its extreme pH.

WHS:

Classification of this product has been carried out in accordance with Model Work Health and Safety Regulations(Hazardous Chemicals) Amendment 2022

Acute Tox. 4: Acute toxicity if swallowed, Category 4, H302
Eye Dam. 1: Serious eye damage, Category 1, H318
Skin Corr. 1B: Skin corrosion, Category 1B, H314
Skin Sens. 1: Sensitisation, skin, Category 1, H317
STOT RE 2: Specific target organ toxicity — Repeated exposure, Hazard Category 2 (Oral), H373

2.2 Label elements, including precautionary statements:

WHS:

Danger

Hazard statements:

Acute Tox. 4: H302 - Harmful if swallowed.
Skin Corr. 1B: H314 - Causes severe skin burns and eye damage.
Skin Sens. 1: H317 - May cause an allergic skin reaction.
STOT RE 2: H373 - May cause damage to organs through prolonged or repeated exposure (Oral).

Precautionary statements:

P280: Wear protective gloves/protective clothing/eye protection/protective footwear.
P301+P330+P331: IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P302+P352: IF ON SKIN: Wash with plenty of soap and water.
P303+P361+P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
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.
P501: Dispose of contents and / or containers in accordance with regulations on hazardous waste or packaging and packaging waste respectively.

Substances that contribute to the classification

Ethanediol (30 - <60 %); Formic acid (10 - <30 %); Cinnamaldehyde (10 - <30 %); Pyridinium, 1-(phenylmethyl)-, ethyl methyl derivs., chlorides (10 - <30 %)

2.3 Other hazards which do not result in classification:

Not available

- CONTINUED ON NEXT PAGE -

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

3.1 Substances:

Non-applicable

3.2 Mixtures:

Chemical description: Mixture of substances

Components:

In accordance with Schedule 8 (WHS Regulations), the product contains:

Identification	Chemical name/Classification	Concentration
CAS: 107-21-1	**Ethanediol** Acute Tox. 4: H302; STOT RE 2: H373 - Warning	**30 - <60 %**
CAS: 64-18-6	**Formic acid** Flam. Liq. 4: H227; Skin Corr. 1A: H314 - Danger	**10 - <30 %**
CAS: 104-55-2	**Cinnamaldehyde** Acute Tox. 4: H312; Eye Irrit. 2A: H319; Skin Irrit. 2: H315; Skin Sens. 1: H317 - Warning	**10 - <30 %**
CAS: 68909-18-2	**Pyridinium, 1-(phenylmethyl)-, ethyl methyl derivs., chlorides** Eye Dam. 1: H318; Flam. Liq. 3: H226; Skin Corr. 1B: H314 - Danger	**10 - <30 %**
CAS: 26571-11-9	**26-(nonylphenoxy)-3,6,9,12,15,18,21,24-octaoxahexacosan-1-ol** Eye Irrit. 2A: H319; Skin Irrit. 2: H315 - Warning	**<10 %**

To obtain more information on the hazards of the substances consult sections 11, 12 and 16.

SECTION 4: FIRST AID MEASURES

4.1 Description of necessary first aid measures:

Request medical assistance immediately, showing the SDS of this product.

By inhalation:

This product does not contain substances classified as hazardous for inhalation, however, in case of symptoms of intoxication remove the person affected from the exposure area and provide with fresh air. Seek medical attention if the symptoms get worse or persist.

By skin contact:

Remove contaminated clothing and footwear, rinse skin or shower the person affected if appropriate with plenty of cold water and neutral soap. In serious cases see a doctor. If the product causes burns or freezing, clothing should not be removed as this could worsen the injury caused if it is stuck to the skin. If blisters form on the skin, these should never be burst as this will increase the risk of infection.

By eye contact:

Rinse eyes thoroughly with lukewarm water for at least 15 minutes. Do not allow the person affected to rub or close their eyes. If the injured person uses contact lenses, these should be removed unless they are stuck to the eyes, as this could cause further damage. In all cases, after cleaning, a doctor should be consulted as quickly as possible with the SDS of the product.

By ingestion/aspiration:

Request immediate medical assistance, showing the SDS of this product. Do not induce vomiting, because its expulsion from the stomach can be hazardous to the mucus of the main digestive tract, and its inhalation, to the respiratory system. Rinse out the mouth and throat, as they may have been affected during ingestion. In the case of loss of consciousness do not administrate anything orally unless supervised by a doctor. Keep the person affected at rest.

4.2 Symptoms caused by exposure:

Acute and delayed effects are indicated in sections 2 and 11.

4.3 Medical attention and special treatment:

Not available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable extinguishing equipment:

Suitable extinguishing media:

- CONTINUED ON NEXT PAGE -

SECTION 5: FIREFIGHTING MEASURES (continued)

Product is non-flammable under normal conditions of storage, manipulation and use, but the product contains flammable substances. In the case of inflammation as a result of improper manipulation, storage or use preferably use polyvalent powder extinguishers (ABC powder), in accordance with the Regulation on fire protection systems.

Unsuitable extinguishing media:

IT IS RECOMMENDED NOT to use full jet water as an extinguishing agent.

5.2 Specific hazards arising from the chemical:

As a result of combustion or thermal decomposition reactive sub-products are created that can become highly toxic and, consequently, can present a serious health risk.

5.3 Special protective equipment and precautions for fire fighters:

Depending on the magnitude of the fire it may be necessary to use full protective clothing and individual respiratory equipment. Minimum emergency facilities and equipment should be available (fire blankets, portable first aid kit,...)

Additional provisions:

Act in accordance with the Internal Emergency Plan and the Information Sheets on actions to take after an accident or other emergencies. Destroy any source of ignition. In case of fire, refrigerate the storage containers and tanks for products susceptible to inflammation, explosion or BLEVE as a result of high temperatures. Avoid spillage of the products used to extinguish the fire into an aqueous medium.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures:

For non-emergency personnel:

Isolate leaks provided that there is no additional risk for the people performing this task. Evacuate the area and keep out those without protection. Personal protection equipment must be used against potential contact with the spilt product (See section 8). Above all prevent the formation of any vapour-air flammable mixtures, through either ventilation or the use of an inert medium. Remove any source of ignition. Eliminate electrostatic charges by interconnecting all the conductive surfaces on which static electricity could form, and also ensuring that all surfaces are connected to the ground.

For emergency responders:

Wear protective equipment. Keep unprotected persons away. See section 8.

6.2 Environmental precautions:

This product is not classified as hazardous to the environment. Keep product away from drains, surface and underground water.

6.3 Methods and materials for containment and cleaning up:

It is recommended:

Absorb the spillage using sand or inert absorbent and move it to a safe place. Do not absorb in sawdust or other combustible absorbents. For any concern related to disposal consult section 13.

6.4 Reference to other sections:

See sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling:

A.- General precautions for safe use

Comply with the current legislation concerning the prevention of industrial risks with regards manually handling weights. Maintain order, cleanliness and dispose of using safe methods (section 6).

B.- Technical recommendations for the prevention of fires and explosions

Avoid the evaporation of the product as it contains flammable substances, which could form flammable vapour/air mixtures in the presence of sources of ignition. Control sources of ignition (mobile phones, sparks,...) and transfer at slow speeds to avoid the creation of electrostatic charges. Consult section 10 for conditions and materials that should be avoided.

C.- Technical recommendations on general occupational hygiene

Do not eat or drink during the process, washing hands afterwards with suitable cleaning products.

D.- Technical recommendations to prevent environmental risks

It is recommended to have absorbent material available at close proximity to the product (See subsection 6.3)

7.2 Conditions for safe storage, including any incompatibilities:

A.- Specific storage requirements

- CONTINUED ON NEXT PAGE -

SECTION 7: HANDLING AND STORAGE (continued)

Minimum Temp.: 5 ºC

Maximum Temp.: 40 ºC

Maximum time: 6 Months

B.- General conditions for storage

Avoid sources of heat, radiation, static electricity and contact with food. For additional information see subsection 10.5

7.3 Specific end use(s):

Except for the instructions already specified it is not necessary to provide any special recommendation regarding the uses of this product.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 Exposure control measures:

Substances whose occupational exposure limits have to be monitored in the workplace:

Workplace Exposure Standards for Airborne Contaminants 01/10/2022:

Identification	Occupational exposure limits		
Ethanediol [1] CAS: 107-21-1	TWA		10 mg/m³
	STEL		
Formic acid CAS: 64-18-6	TWA	5 ppm	9.4 mg/m³
	STEL	10 ppm	19 mg/m³

[1] Skin

8.2 Engineering controls:

A.- Individual protection measures, for example personal protective equipment (PPE)

As a preventative measure it is recommended to use basic Personal Protection Equipment. For more information on Personal Protection Equipment (storage, use, cleaning, maintenance, class of protection,…) consult the information leaflet provided by the manufacturer. For more information see subsection 7.1.
All information contained herein is a recommendation which needs some specification from the labour risk prevention services as it is not known whether the company has additional measures at its disposal.

B.- Respiratory protection

The use of protection equipment will be necessary if a mist forms or if the occupational exposure limits are exceeded.

C.- Specific protection for the hands

Pictogram	PPE	Remarks
 Mandatory hand protection	Chemical protective gloves (Material: Linear low-density polyethylene (LLDPE), Breakthrough time: > 480 min, Thickness: 0.062 mm)	Replace the gloves at any sign of deterioration.

As the product is a mixture of several substances, the resistance of the glove material can not be calculated in advance with total reliability and has therefore to be checked prior to the application.

D.- Eye and face protection

Pictogram	PPE	Remarks
 Mandatory face protection	Panoramic glasses against splash/projections.	Clean daily and disinfect periodically according to the manufacturer´s instructions. Use if there is a risk of splashing.

E.- Bodily protection

Pictogram	PPE	Remarks
	Work clothing	Replace before any evidence of deterioration.

- CONTINUED ON NEXT PAGE -

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION (continued)

Pictogram	PPE	Remarks
	Anti-slip work shoes	Replace before any evidence of deterioration.

F.- Additional emergency measures

Emergency measure	Standards	Emergency measure	Standards
 Emergency shower	ANSI Z358-1 ISO 3864-1:2011, ISO 3864-4:2011	 Eyewash stations	DIN 12 899 ISO 3864-1:2011, ISO 3864-4:2011

Environmental exposure controls:

In accordance with the community legislation for the protection of the environment it is recommended to avoid environmental spillage of both the product and its container. For additional information see subsection 7.1.D

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties:

For complete information see the product datasheet.

Appearance:

Physical state at 20 ºC:	Liquid
Appearance:	Opaque
Color:	Brown
Odor:	Odourless
Odour threshold:	Not available *

Volatility:

Boiling point at atmospheric pressure:	158 ºC
Vapour pressure at 20 ºC:	1503 Pa
Vapour pressure at 50 ºC:	5834.65 Pa (5.83 kPa)
Evaporation rate at 20 ºC:	Not available *

Product description:

Density at 20 ºC:	1113.9 kg/m³
Relative density at 20 ºC:	1.114
Dynamic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 40 ºC:	Not available *
Concentration:	Not available *
pH:	1 - 3
Vapour density at 20 ºC:	Not available *
Partition coefficient n-octanol/water 20 ºC:	Not available *
Solubility in water at 20 ºC:	Not available *
Solubility properties:	Not available *
Decomposition temperature:	Not available *
Melting point/freezing point:	-25 ºC

Flammability:

Flash Point:	>100 ºC
Flammability (solid, gas):	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

Autoignition temperature:	400 ºC
Lower flammability limit:	Not available *
Upper flammability limit:	Not available *
Particle characteristics:	
Median equivalent diameter:	Non-applicable

9.2 Other information:

Information with regard to physical hazard classes:

Explosive properties:	Not available *
Oxidising properties:	Not available *
Corrosive to metals:	Not available *
Heat of combustion:	Not available *
Aerosols-total percentage (by mass) of flammable components:	Not available *
Other safety characteristics:	
Surface tension at 20 ºC:	Not available *
Refraction index:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity:

No hazardous reactions are expected because the product is stable under recommended storage conditions. See section 7 from Safety Data Sheet.

10.2 Chemical stability:

Chemically stable under the indicated conditions of storage, handling and use.

10.3 Possibility of hazardous reactions:

Under the specified conditions, hazardous reactions that lead to excessive temperatures or pressure are not expected.

10.4 Conditions to avoid:

Applicable for handling and storage at room temperature:

Shock and friction	Contact with air	Increase in temperature	Sunlight	Humidity
Not applicable	Not applicable	Precaution	Precaution	Not applicable

10.5 Incompatible materials:

Acids	Water	Oxidising materials	Combustible materials	Others
Not applicable	Not applicable	Precaution	Not applicable	Avoid alkalis or strong bases

10.6 Hazardous decomposition products:

See subsection 10.3, 10.4 and 10.5 to find out the specific decomposition products. Depending on the decomposition conditions, complex mixtures of chemical substances can be released: carbon dioxide (CO_2), carbon monoxide and other organic compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects:

The experimental information related to the toxicological properties of the product itself is not available

Contains glycols. With possibility of effects that are hazardous to the health, it is recommended not to breathe the vapours for long periods of time.

Dangerous health implications:

In case of exposure that is repetitive, prolonged or at concentrations higher than recommended by the occupational exposure limits, it may result in adverse effects on health depending on the means of exposure:

A- Ingestion (acute effect):

- CONTINUED ON NEXT PAGE -

SECTION 11: TOXICOLOGICAL INFORMATION (continued)

- Acute toxicity: The consumption of a considerable dose can cause irritation in the throat, abdominal pain, nausea and vomiting.
- Corrosivity/Irritability: Corrosive product, if it is swallowed causes burns destroying the tissues. For more information about secondary effects from skin contact see section 2.

B- Inhalation (acute effect):

- Acute toxicity : Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for inhalation. For more information see section 3.
- Corrosivity/Irritability: Prolonged inhalation of the product is corrosive to mucous membranes and the upper respiratory tract

C- Contact with the skin and the eyes (acute effect):

- Contact with the skin: Above all, skin contact may occur as fabrics of all thicknesses can be destroyed, resulting in burns. For more information on the secondary effects see section 2.
- Contact with the eyes: Produces serious eye damage after contact.

D- CMR effects (carcinogenicity, mutagenicity and toxicity to reproduction):

- Carcinogenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for the effects mentioned. For more information see section 3.
  IARC: Not available
- Mutagenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Reproductive toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

E- Sensitizing effects:

- Respiratory: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous with sensitising effects. For more information see section 3.
- Skin: Prolonged contact with the skin can result in episodes of allergic contact dermatitis.

F- Specific target organ toxicity (STOT) - single exposure:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

G- Specific target organ toxicity (STOT)-repeated exposure:

- Specific target organ toxicity (STOT)-repeated exposure: Exposure in high concentration can cause a breakdown in the central nervous system causing headache, dizziness, vertigo, nausea, vomiting, confusion, and in serious cases, loss of consciousness.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

H- Aspiration hazard:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

Other information:

Not available

Specific toxicology information on the substances:

Identification	Acute toxicity		Genus
Ethanediol	LD50 oral	500 mg/kg (ATEi)	
CAS: 107-21-1	LD50 dermal	>3500 mg/kg	Rabbit
	LC50 inhalation		
Cinnamaldehyde	LD50 oral	2220 mg/kg	Rat
CAS: 104-55-2	LD50 dermal	1260 mg/kg (ATEi)	Rabbit
	LC50 inhalation	68.88 mg/L (4 h)	Rat

SECTION 12: ECOLOGICAL INFORMATION

The experimental information related to the eco-toxicological properties of the product itself is not available

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

12.1 Ecotoxicity:

Acute toxicity:

- CONTINUED ON NEXT PAGE -

SECTION 12: ECOLOGICAL INFORMATION (continued)

Identification	Concentration		Species	Genus
Ethanediol	LC50	53000 mg/L (96 h)	Pimephales promelas	Fish
CAS: 107-21-1	EC50	51000 mg/L (48 h)	Daphnia magna	Crustacean
	EC50	24000 mg/L (168 h)	Selenastrum capricornutum	Algae
Formic acid	LC50	175 mg/L (24 h)	Lepomis macrochirus	Fish
CAS: 64-18-6	EC50	120 mg/L (48 h)	Daphnia magna	Crustacean
	EC50	26.9 mg/L (72 h)	Scenedesmus subspicatus	Algae
Pyridinium, 1-(phenylmethyl)-, ethyl methyl derivs., chlorides	LC50	14.1 mg/L (96 h)	Cypronodon variegatus	Fish
CAS: 68909-18-2	EC50	3.1 mg/L (48 h)	Daphnia magna	Crustacean
	EC50	0.47 mg/L (72 h)	Pseudokirchneriella subcapitata	Algae

Chronic toxicity:

Identification	Concentration		Species	Genus
Formic acid	NOEC	Not available		
CAS: 64-18-6	NOEC	100 mg/L	Daphnia magna	Crustacean
Cinnamaldehyde	NOEC	15.159 mg/L	N/A	Fish
CAS: 104-55-2	NOEC	Not available		

12.2 Persistence and degradability:

Substance-specific information:

Identification	Degradability		Biodegradability	
Ethanediol	BOD5	0.47 g O2/g	Concentration	100 mg/L
CAS: 107-21-1	COD	1.29 g O2/g	Period	14 days
	BOD5/COD	0.36	% Biodegradable	90 %
Formic acid	BOD5	Not available	Concentration	100 mg/L
CAS: 64-18-6	COD	Not available	Period	14 days
	BOD5/COD	Not available	% Biodegradable	110 %
Pyridinium, 1-(phenylmethyl)-, ethyl methyl derivs., chlorides	BOD5	Not available	Concentration	Not available
CAS: 68909-18-2	COD	1.92 g O2/g	Period	28 days
	BOD5/COD	Not available	% Biodegradable	13 %

12.3 Bioaccumulative potential:

Substance-specific information:

Identification	Bioaccumulation potential	
Ethanediol	BCF	10
CAS: 107-21-1	Pow Log	-1.36
	Potential	Low
Formic acid	BCF	3
CAS: 64-18-6	Pow Log	-0.54
	Potential	Low
Cinnamaldehyde	BCF	8
CAS: 104-55-2	Pow Log	1.9
	Potential	Low

12.4 Mobility in soil:

Identification	Absorption/desorption		Volatility	
Ethanediol	Koc	0	Henry	1.327E-1 Pa·m³/mol
CAS: 107-21-1	Conclusion	Very High	Dry soil	No
	Surface tension	4.989E-2 N/m (25 ºC)	Moist soil	No
Formic acid	Koc	Not available	Henry	Not available
CAS: 64-18-6	Conclusion	Not available	Dry soil	Not available
	Surface tension	3.862E-2 N/m (25 ºC)	Moist soil	Not available
Cinnamaldehyde	Koc	37	Henry	3.546E-1 Pa·m³/mol
CAS: 104-55-2	Conclusion	Very High	Dry soil	Yes
	Surface tension	Not available	Moist soil	Yes

12.5 Results of PBT and vPvB assessment:

- CONTINUED ON NEXT PAGE -

SECTION 12: ECOLOGICAL INFORMATION (continued)

Non-applicable

12.6 Other adverse effects:

Not described

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Disposal methods:

Waste management (disposal and evaluation):

Consult the authorized waste service manager on the assessment and disposal operations. In case the container has been in direct contact with the product, it will be processed the same way as the actual product. Otherwise, it will be processed as non-hazardous residue. Waste should not be disposed of to drains. See epigraph 6.2.

Regulations related to waste management:

Legislation related to waste management:

Basel Convention (Hazardous Waste)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 and Amendments

SECTION 14: TRANSPORT INFORMATION

Transport of dangerous goods by land:

With regard to ADG Code:

14.1	**UN number:**	UN3265
14.2	**Proper shipping name or Technical Name:**	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S. (Formic acid; Pyridinium, 1-(phenylmethyl)-, ethyl methyl derivs., chlorides)
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	II
14.5	**Environmental hazards for Transport Purposes:**	Yes
14.6	**Special precautions for user**	
	Physico-Chemical properties:	see section 9
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

Transport of dangerous goods by sea:

With regard to IMDG 41-22:

14.1	**UN number:**	UN3265
14.2	**Proper shipping name or Technical Name:**	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S. (Formic acid; Pyridinium, 1-(phenylmethyl)-, ethyl methyl derivs., chlorides)
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	II
14.5	**Marine pollutant:**	Yes
14.6	**Special precautions for user**	
	Special regulations:	274
	EmS Codes:	F-A, S-B
	Physico-Chemical properties:	see section 9
	Limited quantities:	1 L
	Segregation group:	SGG1
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

Transport of dangerous goods by air:

With regard to IATA/ICAO 2024:

- CONTINUED ON NEXT PAGE -

SECTION 14: TRANSPORT INFORMATION (continued)

14.1	**UN number:**	UN3265
14.2	**Proper shipping name or Technical Name:**	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S. (Formic acid; Pyridinium, 1-(phenylmethyl)-, ethyl methyl derivs., chlorides)
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	II
14.5	**Environmental hazards for Transport Purposes:**	Yes
14.6	**Special precautions for user**	
	Physico-Chemical properties:	see section 9
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations:

Specific provisions in terms of protecting people or the environment:

It is recommended to use the information included in this safety data sheet as data used in a risk evaluation of the local circumstances in order to establish the necessary risk prevention measures for the manipulation, use, storage and disposal of this product.

Industrial Chemicals Act 2019:

Industrial Chemicals (Notification and Assessment) Act 1989

SECTION 16: OTHER INFORMATION

Legislation related to safety data sheets:
This safety data sheet has been designed in accordance with WHS regulations and Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Texts of the legislative phrases mentioned in section 2:
H373: May cause damage to organs through prolonged or repeated exposure (Oral).
H318: Causes serious eye damage.
H317: May cause an allergic skin reaction.
H302: Harmful if swallowed.
H314: Causes severe skin burns and eye damage.

Texts of the legislative phrases mentioned in section 3:
The phrases indicated do not refer to the product itself; they are present merely for informative purposes and refer to the individual components which appear in section 3

WHS:
Acute Tox. 4: H302 - Harmful if swallowed.
Acute Tox. 4: H312 - Harmful in contact with skin.
Eye Dam. 1: H318 - Causes serious eye damage.
Eye Irrit. 2A: H319 - Causes serious eye irritation.
Flam. Liq. 3: H226 - Flammable liquid and vapour.
Flam. Liq. 4: H227 - Combustible liquid.
Skin Corr. 1A: H314 - Causes severe skin burns and eye damage.
Skin Corr. 1B: H314 - Causes severe skin burns and eye damage.
Skin Irrit. 2: H315 - Causes skin irritation.
Skin Sens. 1: H317 - May cause an allergic skin reaction.
STOT RE 2: H373 - May cause damage to organs through prolonged or repeated exposure (Oral).

Advice related to training:
Minimal training is recommended to prevent industrial risks for staff using this product, in order to facilitate their comprehension and interpretation of this safety data sheet, as well as the label on the product.

Principal bibliographical sources:
http://www.safeworkaustralia.gov.au/

Abbreviations and acronyms:

- CONTINUED ON NEXT PAGE -

SECTION 16: OTHER INFORMATION (continued)

ADG: Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG: International maritime dangerous goods code
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
COD: Chemical Oxygen Demand
BOD5: 5-day biochemical oxygen demand
BCF: Bioconcentration factor
LD50: Lethal Dose 50
CL50: Lethal Concentration 50
EC50: Effective concentration 50
Log-POW: Octanol-water partition coefficient
Koc: Partition coefficient of organic carbon
IARC: International Agency for Research on Cancer

END OF SAFETY DATA SHEET

SECTION 1: IDENTIFICATION

1.1 Product identifier: Al-Fe-1F

2,3-didehydro-3-O-sodio-D-erythro-hexono-1,4-lactone

CAS: 6381-77-7

Other means of identification:

Not available

1.2 Recommended use of the chemical and restrictions on use:

Relevant uses: Chemical industry. For professional users only.

Uses advised against: All uses not specified in this section or in section 7.3

1.3 Details of manufacturer or importer:

Fusion Technologies (Australia) Pty
Unit 3, 1472 Boundary Road
Wacol, Queensland 4076, Australia
Phone: +61 460 047 656
https://www.fusiontechinc.net/

Technical Inquries: help@fusiontechinc.net

1.4 Emergency phone number: **AU 1800 033 111 NZ 0800 734 607 (ALL HOURS)**

SECTION 2: HAZARD(S) IDENTIFICATION

2.1 Classification of the hazardous chemical:

WHS:

Classification of this product has been carried out in accordance with Model Work Health and Safety Regulations(Hazardous Chemicals) Amendment 2022

Eye Irrit. 2A: Eye irritation, Category 2A, H319
Skin Irrit. 2: Skin irritation, Category 2, H315
STOT SE 3: Respiratory tract toxicity, single exposure, Category 3, H335

2.2 Label elements, including precautionary statements:

WHS:

Warning

Hazard statements:

Eye Irrit. 2A: H319 - Causes serious eye irritation.
Skin Irrit. 2: H315 - Causes skin irritation.
STOT SE 3: H335 - May cause respiratory irritation.

Precautionary statements:

P264: Wash thoroughly after use.
P271: Use only outdoors or in a well-ventilated area.
P280: Wear protective gloves/protective clothing/respiratory protection/eye protection/protective footwear.
P302+P352: IF ON SKIN: Wash with plenty of soap and water.
P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P403+P233: Store in a well-ventilated place. Keep container tightly closed.
P501: Dispose of contents and / or containers in accordance with regulations on hazardous waste or packaging and packaging waste respectively.

2.3 Other hazards which do not result in classification:

Not available

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

3.1 Substances:

Chemical description: Mixture of substances

- CONTINUED ON NEXT PAGE -

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8 (continued)

In accordance with Schedule 8 (WHS Regulations), the product contains:

Identification	Chemical name/Classification	Concentration
CAS: 6381-77-7	**2,3-didehydro-3-O-sodio-D-erythro-hexono-1,4-lactone** Eye Irrit. 2A: H319; Skin Irrit. 2: H315; STOT SE 3: H335 - Warning	**100 %**

To obtain more information on the hazards of the substances consult sections 11, 12 and 16.

3.2 Mixtures:

Non-applicable

SECTION 4: FIRST AID MEASURES

4.1 Description of necessary first aid measures:

The symptoms resulting from intoxication can appear after exposure, therefore, in case of doubt, seek medical attention for direct exposure to the chemical product or persistent discomfort, showing the SDS of this product.

By inhalation:

Remove the person affected from the area of exposure, provide with fresh air and keep at rest. In serious cases such as cardiorespiratory failure, artificial resuscitation techniques will be necessary (mouth to mouth resuscitation, cardiac massage, oxygen supply, etc.) requiring immediate medical assistance.

By skin contact:

Remove contaminated clothing and footwear, rinse skin or shower the person affected if appropriate with plenty of cold water and neutral soap. In serious cases see a doctor. If the product causes burns or freezing, clothing should not be removed as this could worsen the injury caused if it is stuck to the skin. If blisters form on the skin, these should never be burst as this will increase the risk of infection.

By eye contact:

Rinse eyes thoroughly with lukewarm water for at least 15 minutes. Do not allow the person affected to rub or close their eyes. If the injured person uses contact lenses, these should be removed unless they are stuck to the eyes, as this could cause further damage. In all cases, after cleaning, a doctor should be consulted as quickly as possible with the SDS of the product.

By ingestion/aspiration:

Do not induce vomiting, but if it does happen keep the head down to avoid aspiration. Keep the person affected at rest. Rinse out the mouth and throat, as they may have been affected during ingestion.

4.2 Symptoms caused by exposure:

Acute and delayed effects are indicated in sections 2 and 11.

4.3 Medical attention and special treatment:

Not available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable extinguishing equipment:

Suitable extinguishing media:

Product is non-flammable under normal conditions of storage, handling and use. In the case of combustion as a result of improper handling, storage or use preferably use polyvalent powder extinguishers (ABC powder), in accordance with the Regulation on fire protection systems.

Unsuitable extinguishing media:

Non-applicable

5.2 Specific hazards arising from the chemical:

As a result of combustion or thermal decomposition reactive sub-products are created that can become highly toxic and, consequently, can present a serious health risk.

5.3 Special protective equipment and precautions for fire fighters:

Depending on the magnitude of the fire it may be necessary to use full protective clothing and individual respiratory equipment. Minimum emergency facilities and equipment should be available (fire blankets, portable first aid kit,...)

Additional provisions:

- CONTINUED ON NEXT PAGE -

SECTION 5: FIREFIGHTING MEASURES (continued)

Act in accordance with the Internal Emergency Plan and the Information Sheets on actions to take after an accident or other emergencies. Destroy any source of ignition. In case of fire, refrigerate the storage containers and tanks for products susceptible to inflammation, explosion or BLEVE as a result of high temperatures. Avoid spillage of the products used to extinguish the fire into an aqueous medium.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures:

For non-emergency personnel:

Sweep up and shovel product or other means and place in container for reuse (preferred) or disposal

For emergency responders:

Wear protective equipment. Keep unprotected persons away. See section 8.

6.2 Environmental precautions:

This product is not classified as hazardous to the environment. Keep product away from drains, surface and underground water.

6.3 Methods and materials for containment and cleaning up:

It is recommended:

Sweep up and shovel product or other means and place in container for reuse (preferred) or disposal

6.4 Reference to other sections:

See sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling:

A.- General precautions for safe use

Comply with the current legislation concerning the prevention of industrial risks. Keep containers hermetically sealed. Control spills and residues, destroying them with safe methods (section 6). Avoid leakages from the container. Maintain order and cleanliness where dangerous products are used.

B.- Technical recommendations for the prevention of fires and explosions

Due to its non-flammable nature, the product does not present a fire risk under normal conditions of storage, manipulation and use.

C.- Technical recommendations on general occupational hygiene

Do not eat or drink during the process, washing hands afterwards with suitable cleaning products.

D.- Technical recommendations to prevent environmental risks

It is recommended to have absorbent material available at close proximity to the product (See subsection 6.3)

7.2 Conditions for safe storage, including any incompatibilities:

A.- Specific storage requirements

Minimum Temp.:	5 ºC
Maximum Temp.:	40 ºC
Maximum time:	6 Months

B.- General conditions for storage

Avoid sources of heat, radiation, static electricity and contact with food. For additional information see subsection 10.5

7.3 Specific end use(s):

Except for the instructions already specified it is not necessary to provide any special recommendation regarding the uses of this product.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 Exposure control measures:

Substances whose occupational exposure limits have to be monitored in the workplace:

Nuisance dust: Inhalable dust 10 mg/m3 // Respirable dust 4 mg/m3

- CONTINUED ON NEXT PAGE -

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION (continued)

8.2 Engineering controls:

A.- Individual protection measures, for example personal protective equipment (PPE)

As a preventative measure it is recommended to use basic Personal Protection Equipment. For more information on Personal Protection Equipment (storage, use, cleaning, maintenance, class of protection,…) consult the information leaflet provided by the manufacturer. For more information see subsection 7.1.
All information contained herein is a recommendation which needs some specification from the labour risk prevention services as it is not known whether the company has additional measures at its disposal.

B.- Respiratory protection

Pictogram	PPE	Remarks
 Mandatory respiratory tract protection	Filter mask for gases, vapours and particles	Replace when an increase in resistence to breathing is observed and/or a smell or taste of the contaminant is detected.

C.- Specific protection for the hands

Pictogram	PPE	Remarks
 Mandatory hand protection	Protective gloves against minor risks	Replace gloves in case of any sign of damage. For prolonged periods of exposure to the product for professional users/industrials, we recommend using chemical protection gloves

D.- Eye and face protection

Pictogram	PPE	Remarks
 Mandatory face protection	Panoramic glasses against splash/projections.	Clean daily and disinfect periodically according to the manufacturer´s instructions. Use if there is a risk of splashing.

E.- Bodily protection

Pictogram	PPE	Remarks
	Work clothing	Replace before any evidence of deterioration.
	Anti-slip work shoes	Replace before any evidence of deterioration.

F.- Additional emergency measures

Emergency measure	Standards	Emergency measure	Standards
 Emergency shower	ANSI Z358-1 ISO 3864-1:2011, ISO 3864-4:2011	 Eyewash stations	DIN 12 899 ISO 3864-1:2011, ISO 3864-4:2011

Environmental exposure controls:

In accordance with the community legislation for the protection of the environment it is recommended to avoid environmental spillage of both the product and its container. For additional information see subsection 7.1.D

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties:

For complete information see the product datasheet.

Appearance:

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

Physical state at 20 ºC:	Solid
Appearance:	Granulated
Color:	☐ White
Odor:	Odourless
Odour threshold:	Not available *
Volatility:	
Boiling point at atmospheric pressure:	Not available *
Vapour pressure at 20 ºC:	Not available *
Vapour pressure at 50 ºC:	Not available *
Evaporation rate at 20 ºC:	Not available *
Product description:	
Bulk Density at 20 ºC:	0.8 g/cc
Relative density at 20 ºC:	1.2
Dynamic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 40 ºC:	Not available *
Concentration:	Not available *
pH:	7.5 +/- 0.5 (1% aqueous)
Vapour density at 20 ºC:	Not available *
Partition coefficient n-octanol/water 20 ºC:	Not available *
Solubility in water at 20 ºC:	Not available *
Solubility properties:	Not available *
Decomposition temperature:	Not available *
Melting point/freezing point:	169 - 171 ºC
Flammability:	
Flash Point:	Non-applicable
Flammability (solid, gas):	Not available *
Autoignition temperature:	Not available *
Lower flammability limit:	Not available *
Upper flammability limit:	Not available *
Explosive (Solid):	
Lower explosive limit:	Not available *
Upper explosive limit:	Not available *
Particle characteristics:	
Median equivalent diameter:	Not available *

9.2 Other information:

Information with regard to physical hazard classes:	
Explosive properties:	Not available *
Oxidising properties:	Not available *
Corrosive to metals:	Not available *
Heat of combustion:	Not available *
Aerosols-total percentage (by mass) of flammable components:	Not available *
Other safety characteristics:	
Surface tension at 20 ºC:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

Refraction index: Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity:

No hazardous reactions are expected because the product is stable under recommended storage conditions. See section 7 from Safety Data Sheet.

10.2 Chemical stability:

Chemically stable under the indicated conditions of storage, handling and use.

10.3 Possibility of hazardous reactions:

Under the specified conditions, hazardous reactions that lead to excessive temperatures or pressure are not expected.

10.4 Conditions to avoid:

Applicable for handling and storage at room temperature:

Shock and friction	Contact with air	Increase in temperature	Sunlight	Humidity
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

10.5 Incompatible materials:

Acids	Water	Oxidising materials	Combustible materials	Others
Avoid strong acids	Not applicable	Not applicable	Not applicable	Avoid alkalis or strong bases

10.6 Hazardous decomposition products:

See subsection 10.3, 10.4 and 10.5 to find out the specific decomposition products. Depending on the decomposition conditions, complex mixtures of chemical substances can be released: carbon dioxide (CO_2), carbon monoxide and other organic compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects:

The experimental information related to the toxicological properties of the product itself is not available

Dangerous health implications:

In case of exposure that is repetitive, prolonged or at concentrations higher than recommended by the occupational exposure limits, it may result in adverse effects on health depending on the means of exposure:

A- Ingestion (acute effect):

- Acute toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for consumption. For more information see section 3
- Corrosivity/Irritability: The consumption of a considerable dose can cause irritation in the throat, abdominal pain, nausea and vomiting.

B- Inhalation (acute effect):

- Acute toxicity : Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for inhalation. For more information see section 3.
- Corrosivity/Irritability: Causes irritation in respiratory passages, which is normally reversible and limited to the upper respiratory passages.

C- Contact with the skin and the eyes (acute effect):

- Contact with the skin: Produces skin inflammation.
- Contact with the eyes: Produces eye irritation after contact.

D- CMR effects (carcinogenicity, mutagenicity and toxicity to reproduction):

- Carcinogenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for the effects mentioned. For more information see section 3.
  IARC: Not available
- Mutagenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Reproductive toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

E- Sensitizing effects:

- CONTINUED ON NEXT PAGE -

SECTION 11: TOXICOLOGICAL INFORMATION (continued)

- Respiratory: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous with sensitising effects. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

F- Specific target organ toxicity (STOT) - single exposure:

Causes irritation in respiratory passages, which is normally reversible and limited to the upper respiratory passages.

G- Specific target organ toxicity (STOT)-repeated exposure:

- Specific target organ toxicity (STOT)-repeated exposure: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

H- Aspiration hazard:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

Other information:

Not available

Specific toxicology information on the substances:

Not available

SECTION 12: ECOLOGICAL INFORMATION

The experimental information related to the eco-toxicological properties of the product itself is not available

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

12.1 Ecotoxicity:

Not available

12.2 Persistence and degradability:

Not available

12.3 Bioaccumulative potential:

Not available

12.4 Mobility in soil:

Not available

12.5 Results of PBT and vPvB assessment:

Non-applicable

12.6 Other adverse effects:

Not described

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Disposal methods:

Waste management (disposal and evaluation):

Consult the authorized waste service manager on the assessment and disposal operations. In case the container has been in direct contact with the product, it will be processed the same way as the actual product. Otherwise, it will be processed as non-hazardous residue. Waste should not be disposed of to drains. See epigraph 6.2.

Regulations related to waste management:

Legislation related to waste management:

Basel Convention (Hazardous Waste)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 and Amendments

- CONTINUED ON NEXT PAGE -

SECTION 14: TRANSPORT INFORMATION

This product is not regulated for transport.

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations:

Specific provisions in terms of protecting people or the environment:

It is recommended to use the information included in this safety data sheet as data used in a risk evaluation of the local circumstances in order to establish the necessary risk prevention measures for the manipulation, use, storage and disposal of this product.

Industrial Chemicals Act 2019:

Industrial Chemicals (Notification and Assessment) Act 1989

SECTION 16: OTHER INFORMATION

Legislation related to safety data sheets:

This safety data sheet has been designed in accordance with WHS regulations and Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Texts of the legislative phrases mentioned in section 2:

H315: Causes skin irritation.
H335: May cause respiratory irritation.
H319: Causes serious eye irritation.

Texts of the legislative phrases mentioned in section 3:

The phrases indicated do not refer to the product itself; they are present merely for informative purposes and refer to the individual components which appear in section 3

WHS:

Eye Irrit. 2A: H319 - Causes serious eye irritation.
Skin Irrit. 2: H315 - Causes skin irritation.
STOT SE 3: H335 - May cause respiratory irritation.

Advice related to training:

Minimal training is recommended to prevent industrial risks for staff using this product, in order to facilitate their comprehension and interpretation of this safety data sheet, as well as the label on the product.

Principal bibliographical sources:

http://www.safeworkaustralia.gov.au/

Abbreviations and acronyms:

ADG: Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG: International maritime dangerous goods code
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
COD: Chemical Oxygen Demand
BOD5: 5-day biochemical oxygen demand
BCF: Bioconcentration factor
LD50: Lethal Dose 50
CL50: Lethal Concentration 50
EC50: Effective concentration 50
Log-POW: Octanol-water partition coefficient
Koc: Partition coefficient of organic carbon
IARC: International Agency for Research on Cancer

END OF SAFETY DATA SHEET

SECTION 1: IDENTIFICATION

1.1 Product identifier: BFH-1F

Other means of identification:

Not available

1.2 Recommended use of the chemical and restrictions on use:

Relevant uses: Buffer. For professional users only.

Uses advised against: All uses not specified in this section or in section 7.3

1.3 Details of manufacturer or importer:

Fusion Technologies (Australia) Pty
Unit 3, 1472 Boundary Road
Wacol, Queensland 4076, Australia
Phone: +61 460 047 656
https://www.fusiontechinc.net/

Technical Inquries: help@fusiontechinc.net

1.4 Emergency phone number: **AU 1800 033 111 NZ 0800 734 607 (ALL HOURS)**

SECTION 2: HAZARD(S) IDENTIFICATION

2.1 Classification of the hazardous chemical:

WHS:

Classification of this product has been carried out in accordance with Model Work Health and Safety Regulations(Hazardous Chemicals) Amendment 2022

Eye Dam. 1: Serious eye damage, Category 1, H318
Met. Corr. 1: Corrosive to metals, Category 1, H290
Skin Corr. 1A: Skin corrosion, Category 1A, H314

2.2 Label elements, including precautionary statements:

WHS:

Danger

Hazard statements:

Met. Corr. 1: H290 - May be corrosive to metals.
Skin Corr. 1A: H314 - Causes severe skin burns and eye damage.

Precautionary statements:

P234: Keep only in original container.
P264: Wash thoroughly after use.
P280: Wear protective gloves/face protection/protective clothing/protective footwear.
P301+P330+P331: IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P303+P361+P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
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.

Substances that contribute to the classification

Sodium hydroxide (30 - <60 %)

2.3 Other hazards which do not result in classification:

Not available

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

3.1 Substances:

Non-applicable

3.2 Mixtures:

Chemical description: Chemical substance

- CONTINUED ON NEXT PAGE -

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8 (continued)

Components:

In accordance with Schedule 8 (WHS Regulations), the product contains:

Identification	Chemical name/Classification	Concentration
CAS: 1310-73-2	**Sodium hydroxide** Eye Dam. 1: H318; Met. Corr. 1: H290; Skin Corr. 1A: H314 - Danger	**30 - <60 %**

To obtain more information on the hazards of the substances consult sections 11, 12 and 16.

SECTION 4: FIRST AID MEASURES

4.1 Description of necessary first aid measures:

Request medical assistance immediately, showing the SDS of this product.

By inhalation:

This product does not contain substances classified as hazardous for inhalation, however, in case of symptoms of intoxication remove the person affected from the exposure area and provide with fresh air. Seek medical attention if the symptoms get worse or persist.

By skin contact:

Remove contaminated clothing and footwear, rinse skin or shower the person affected if appropriate with plenty of cold water and neutral soap. In serious cases see a doctor. If the product causes burns or freezing, clothing should not be removed as this could worsen the injury caused if it is stuck to the skin. If blisters form on the skin, these should never be burst as this will increase the risk of infection.

By eye contact:

Rinse eyes thoroughly with lukewarm water for at least 15 minutes. Do not allow the person affected to rub or close their eyes. If the injured person uses contact lenses, these should be removed unless they are stuck to the eyes, as this could cause further damage. In all cases, after cleaning, a doctor should be consulted as quickly as possible with the SDS of the product.

By ingestion/aspiration:

Request immediate medical assistance, showing the SDS of this product. Do not induce vomiting, because its expulsion from the stomach can be hazardous to the mucus of the main digestive tract, and its inhalation, to the respiratory system. Rinse out the mouth and throat, as they may have been affected during ingestion. In the case of loss of consciousness do not administrate anything orally unless supervised by a doctor. Keep the person affected at rest.

4.2 Symptoms caused by exposure:

Acute and delayed effects are indicated in sections 2 and 11.

4.3 Medical attention and special treatment:

Not available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable extinguishing equipment:

Suitable extinguishing media:

Product is non-flammable under normal conditions of storage, handling and use. In the case of combustion as a result of improper handling, storage or use preferably use polyvalent powder extinguishers (ABC powder), in accordance with the Regulation on fire protection systems.

Unsuitable extinguishing media:

Non-applicable

5.2 Specific hazards arising from the chemical:

As a result of combustion or thermal decomposition reactive sub-products are created that can become highly toxic and, consequently, can present a serious health risk.

5.3 Special protective equipment and precautions for fire fighters:

Depending on the magnitude of the fire it may be necessary to use full protective clothing and individual respiratory equipment. Minimum emergency facilities and equipment should be available (fire blankets, portable first aid kit,...)

Additional provisions:

- CONTINUED ON NEXT PAGE -

SECTION 5: FIREFIGHTING MEASURES (continued)

Act in accordance with the Internal Emergency Plan and the Information Sheets on actions to take after an accident or other emergencies. Destroy any source of ignition. In case of fire, refrigerate the storage containers and tanks for products susceptible to inflammation, explosion or BLEVE as a result of high temperatures. Avoid spillage of the products used to extinguish the fire into an aqueous medium.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures:

For non-emergency personnel:

Isolate leaks provided that there is no additional risk for the people performing this task. Personal protection equipment must be used against potential contact with the spilt product (See section 8). Evacuate the area and keep out those who do not have protection.

For emergency responders:

Wear protective equipment. Keep unprotected persons away. See section 8.

6.2 Environmental precautions:

This product is not classified as hazardous to the environment. Keep product away from drains, surface and underground water.

6.3 Methods and materials for containment and cleaning up:

It is recommended:

Absorb the spillage using sand or inert absorbent and move it to a safe place. Do not absorb in sawdust or other combustible absorbents. For any concern related to disposal consult section 13.

6.4 Reference to other sections:

See sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling:

A.- General precautions for safe use

Comply with the current legislation concerning the prevention of industrial risks. Control spills and residues, destroying them with safe methods (section 6). Avoid leakages from the container. Maintain order and cleanliness where dangerous products are used. KEEP ONLY IN ORIGINAL CONTAINER.

B.- Technical recommendations for the prevention of fires and explosions

Product is non-flammable under normal conditions of storage, manipulation and use. It is recommended to transfer at slow speeds to avoid the generation of electrostatic charges that can affect flammable products. Consult section 10 for information on conditions and materials that should be avoided.

C.- Technical recommendations on general occupational hygiene

Do not eat or drink during the process, washing hands afterwards with suitable cleaning products.

D.- Technical recommendations to prevent environmental risks

It is recommended to have absorbent material available at close proximity to the product (See subsection 6.3)

7.2 Conditions for safe storage, including any incompatibilities:

A.- Specific storage requirements

Minimum Temp.:	5 ºC
Maximum Temp.:	40 ºC
Maximum time:	6 Months

B.- General conditions for storage

Avoid sources of heat, radiation, static electricity and contact with food. For additional information see subsection 10.5

7.3 Specific end use(s):

Except for the instructions already specified it is not necessary to provide any special recommendation regarding the uses of this product.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 Exposure control measures:

- CONTINUED ON NEXT PAGE -

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION (continued)

Substances whose occupational exposure limits have to be monitored in the workplace:

Workplace Exposure Standards for Airborne Contaminants 01/10/2022:

Identification	Occupational exposure limits		
Sodium hydroxide	TWA		2 mg/m³
CAS: 1310-73-2	STEL		

8.2 Engineering controls:

A.- Individual protection measures, for example personal protective equipment (PPE)

As a preventative measure it is recommended to use basic Personal Protection Equipment. For more information on Personal Protection Equipment (storage, use, cleaning, maintenance, class of protection,…) consult the information leaflet provided by the manufacturer. For more information see subsection 7.1.
All information contained herein is a recommendation which needs some specification from the labour risk prevention services as it is not known whether the company has additional measures at its disposal.

B.- Respiratory protection

The use of protection equipment will be necessary if a mist forms or if the occupational exposure limits are exceeded.

C.- Specific protection for the hands

Pictogram	PPE	Remarks
 Mandatory hand protection	Chemical protective gloves (Material: Linear low-density polyethylene (LLDPE), Breakthrough time: > 480 min, Thickness: 0.062 mm)	Replace the gloves at any sign of deterioration.

As the product is a mixture of several substances, the resistance of the glove material can not be calculated in advance with total reliability and has therefore to be checked prior to the application.

D.- Eye and face protection

Pictogram	PPE	Remarks
 Mandatory face protection	Face shield	Clean daily and disinfect periodically according to the manufacturer´s instructions. Use if there is a risk of splashing.

E.- Bodily protection

Pictogram	PPE	Remarks
 Mandatory complete body protection	Disposable clothing for protection against chemical risks	For professional use only. Clean periodically according to the manufacturer´s instructions.
 Mandatory foot protection	Safety footwear for protection against chemical risk	Replace boots at any sign of deterioration.

F.- Additional emergency measures

Emergency measure	Standards	Emergency measure	Standards
 Emergency shower	ANSI Z358-1 ISO 3864-1:2011, ISO 3864-4:2011	 Eyewash stations	DIN 12 899 ISO 3864-1:2011, ISO 3864-4:2011

Environmental exposure controls:

In accordance with the community legislation for the protection of the environment it is recommended to avoid environmental spillage of both the product and its container. For additional information see subsection 7.1.D

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

*Not available due to the nature of the product, not providing information property of its hazards.

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SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

9.1 Information on basic physical and chemical properties:

For complete information see the product datasheet.

Appearance:

Physical state at 20 ºC:	Liquid
Appearance:	Colorless
Color:	Colourless
Odor:	Characteristic
Odour threshold:	Not available *

Volatility:

Boiling point at atmospheric pressure:	100 ºC
Vapour pressure at 20 ºC:	2350 Pa
Vapour pressure at 50 ºC:	12381.01 Pa (12.38 kPa)
Evaporation rate at 20 ºC:	Not available *

Product description:

Density at 20 ºC:	1217.8 kg/m³
Relative density at 20 ºC:	1.3 - 1.33
Dynamic viscosity at 20 ºC:	1.79 cP
Kinematic viscosity at 20 ºC:	1.47 mm²/s
Kinematic viscosity at 40 ºC:	Not available *
Concentration:	Not available *
pH:	13 - 14
Vapour density at 20 ºC:	Not available *
Partition coefficient n-octanol/water 20 ºC:	Not available *
Solubility in water at 20 ºC:	Not available *
Solubility properties:	Water-soluble
Decomposition temperature:	Not available *
Melting point/freezing point:	0 ºC

Flammability:

Flash Point:	Non Flammable (>93 ºC)
Flammability (solid, gas):	Not available *
Autoignition temperature:	Not available *
Lower flammability limit:	Not available *
Upper flammability limit:	Not available *

Particle characteristics:

Median equivalent diameter:	Non-applicable

9.2 Other information:

Information with regard to physical hazard classes:

Explosive properties:	Not available *
Oxidising properties:	Not available *
Corrosive to metals:	H290 May be corrosive to metals.
Heat of combustion:	Not available *
Aerosols-total percentage (by mass) of flammable components:	Not available *

Other safety characteristics:

Surface tension at 20 ºC:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

Refraction index: Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity:

No hazardous reactions are expected because the product is stable under recommended storage conditions. See section 7 from Safety Data Sheet.

10.2 Chemical stability:

Chemically stable under the indicated conditions of storage, handling and use.

10.3 Possibility of hazardous reactions:

Under the specified conditions, hazardous reactions that lead to excessive temperatures or pressure are not expected.

10.4 Conditions to avoid:

Applicable for handling and storage at room temperature:

Shock and friction	Contact with air	Increase in temperature	Sunlight	Humidity
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

10.5 Incompatible materials:

Acids	Water	Oxidising materials	Combustible materials	Others
Avoid strong acids	Not applicable	Precaution	Not applicable	Not applicable

10.6 Hazardous decomposition products:

See subsection 10.3, 10.4 and 10.5 to find out the specific decomposition products. Depending on the decomposition conditions, complex mixtures of chemical substances can be released: carbon dioxide (CO_2), carbon monoxide and other organic compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects:

The experimental information related to the toxicological properties of the product itself is not available

Dangerous health implications:

In case of exposure that is repetitive, prolonged or at concentrations higher than recommended by the occupational exposure limits, it may result in adverse effects on health depending on the means of exposure:

A- Ingestion (acute effect):

- Acute toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for consumption. For more information see section 3
- Corrosivity/Irritability: Corrosive product, if it is swallowed causes burns destroying the tissues. For more information about secondary effects from skin contact see section 2.

B- Inhalation (acute effect):

- Acute toxicity : Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for inhalation. For more information see section 3.
- Corrosivity/Irritability: Prolonged inhalation of the product is corrosive to mucous membranes and the upper respiratory tract

C- Contact with the skin and the eyes (acute effect):

- Contact with the skin: Above all, skin contact may occur as fabrics of all thicknesses can be destroyed, resulting in burns. For more information on the secondary effects see section 2.
- Contact with the eyes: Produces serious eye damage after contact.

D- CMR effects (carcinogenicity, mutagenicity and toxicity to reproduction):

- Carcinogenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for the effects mentioned. For more information see section 3.
  IARC: Not available
- Mutagenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Reproductive toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

E- Sensitizing effects:

- CONTINUED ON NEXT PAGE -

SECTION 11: TOXICOLOGICAL INFORMATION (continued)

- Respiratory: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous with sensitising effects. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

F- Specific target organ toxicity (STOT) - single exposure:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

G- Specific target organ toxicity (STOT)-repeated exposure:

- Specific target organ toxicity (STOT)-repeated exposure: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

H- Aspiration hazard:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

Other information:

Not available

Specific toxicology information on the substances:

Not available

SECTION 12: ECOLOGICAL INFORMATION

The experimental information related to the eco-toxicological properties of the product itself is not available

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

12.1 Ecotoxicity:

Acute toxicity:

Identification	Concentration		Species	Genus
Sodium hydroxide	LC50	189 mg/L (48 h)	Leuciscus idus	Fish
CAS: 1310-73-2	EC50	33 mg/L	Crangon crangon	Crustacean
	EC50	Not available		

12.2 Persistence and degradability:

Not available

12.3 Bioaccumulative potential:

Not available

12.4 Mobility in soil:

Not available

12.5 Results of PBT and vPvB assessment:

Non-applicable

12.6 Other adverse effects:

Not described

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Disposal methods:

Waste management (disposal and evaluation):

Consult the authorized waste service manager on the assessment and disposal operations. In case the container has been in direct contact with the product, it will be processed the same way as the actual product. Otherwise, it will be processed as non-hazardous residue. Waste should not be disposed of to drains. See epigraph 6.2.

Regulations related to waste management:

Legislation related to waste management:

- CONTINUED ON NEXT PAGE -

SECTION 13: DISPOSAL CONSIDERATIONS (continued)

Basel Convention (Hazardous Waste)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 and Amendments

SECTION 14: TRANSPORT INFORMATION

Transport of dangerous goods by land:

With regard to ADG Code:

14.1	**UN number:**	UN1824
14.2	**Proper shipping name or Technical Name:**	SODIUM HYDROXIDE SOLUTION
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	II
14.5	**Environmental hazards for Transport Purposes:**	No
14.6	**Special precautions for user**	
	Physico-Chemical properties:	see section 9
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

Transport of dangerous goods by sea:

With regard to IMDG 41-22:

14.1	**UN number:**	UN1824
14.2	**Proper shipping name or Technical Name:**	SODIUM HYDROXIDE SOLUTION
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	II
14.5	**Marine pollutant:**	No
14.6	**Special precautions for user**	
	Special regulations:	Not available
	EmS Codes:	F-A, S-B
	Physico-Chemical properties:	see section 9
	Limited quantities:	1 L
	Segregation group:	SGG18
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

Transport of dangerous goods by air:

With regard to IATA/ICAO 2024:

14.1	**UN number:**	UN1824
14.2	**Proper shipping name or Technical Name:**	SODIUM HYDROXIDE SOLUTION
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	II
14.5	**Environmental hazards for Transport Purposes:**	No
14.6	**Special precautions for user**	
	Physico-Chemical properties:	see section 9
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations:

- CONTINUED ON NEXT PAGE -

SECTION 15: REGULATORY INFORMATION (continued)

Specific provisions in terms of protecting people or the environment:

It is recommended to use the information included in this safety data sheet as data used in a risk evaluation of the local circumstances in order to establish the necessary risk prevention measures for the manipulation, use, storage and disposal of this product.

Industrial Chemicals Act 2019:

Industrial Chemicals (Notification and Assessment) Act 1989

SECTION 16: OTHER INFORMATION

Legislation related to safety data sheets:

This safety data sheet has been designed in accordance with WHS regulations and Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Texts of the legislative phrases mentioned in section 2:

H290: May be corrosive to metals.
H318: Causes serious eye damage.
H314: Causes severe skin burns and eye damage.

Texts of the legislative phrases mentioned in section 3:

The phrases indicated do not refer to the product itself; they are present merely for informative purposes and refer to the individual components which appear in section 3

WHS:

Eye Dam. 1: H318 - Causes serious eye damage.
Met. Corr. 1: H290 - May be corrosive to metals.
Skin Corr. 1A: H314 - Causes severe skin burns and eye damage.

Advice related to training:

Minimal training is recommended to prevent industrial risks for staff using this product, in order to facilitate their comprehension and interpretation of this safety data sheet, as well as the label on the product.

Principal bibliographical sources:

http://www.safeworkaustralia.gov.au/

Abbreviations and acronyms:

ADG: Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG: International maritime dangerous goods code
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
COD: Chemical Oxygen Demand
BOD5: 5-day biochemical oxygen demand
BCF: Bioconcentration factor
LD50: Lethal Dose 50
CL50: Lethal Concentration 50
EC50: Effective concentration 50
Log-POW: Octanol-water partition coefficient
Koc: Partition coefficient of organic carbon
IARC: International Agency for Research on Cancer

END OF SAFETY DATA SHEET

SECTION 1: IDENTIFICATION

1.1 Product identifier: BFL-1F

Other means of identification:

Not available

1.2 Recommended use of the chemical and restrictions on use:

Relevant uses: Buffer. For professional users only.

Uses advised against: All uses not specified in this section or in section 7.3

1.3 Details of manufacturer or importer:

Fusion Technologies (Australia) Pty
Unit 3, Westway Industrial Park 1472 Boundary Road
4076 Wacol - Queensland - Australia
Phone: +61 460 047 656
https://www.fusiontechinc.net/

Technical Inquries: help@fusiontechinc.net

1.4 Emergency phone number: AU 1800 033 111 NZ 0800 734 607 (ALL HOURS)

SECTION 2: HAZARD(S) IDENTIFICATION

2.1 Classification of the hazardous chemical:

WHS:

Classification of this product has been carried out in accordance with Model Work Health and Safety Regulations(Hazardous Chemicals) Amendment 2022

Eye Dam. 1: Serious eye damage, Category 1, H318
Flam. Liq. 4: Flammable liquids, Category 4, H227
Met. Corr. 1: Corrosive to metals, Category 1, H290
Skin Corr. 1A: Skin corrosion, Category 1A, H314

2.2 Label elements, including precautionary statements:

WHS:

Danger

Hazard statements:

Flam. Liq. 4: H227 - Combustible liquid.
Met. Corr. 1: H290 - May be corrosive to metals.
Skin Corr. 1A: H314 - Causes severe skin burns and eye damage.

Precautionary statements:

P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P280: Wear protective gloves/face protection/protective clothing/protective footwear.
P301+P330+P331: IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P303+P361+P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P370+P378: In case of fire: Use Foam extinguisher (AB), Dry Chemical Powder (ABC) Fire Extinguisher, Carbon dioxide extinguisher (BC) to extinguish.
P501: Dispose of contents and / or containers in accordance with regulations on hazardous waste or packaging and packaging waste respectively.

Substances that contribute to the classification

Acetic acid (60 - <100 %)

2.3 Other hazards which do not result in classification:

Not available

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

3.1 Substances:

- CONTINUED ON NEXT PAGE -

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8 (continued)

Non-applicable

3.2 Mixtures:

Chemical description: Chemical substance

Components:

In accordance with Schedule 8 (WHS Regulations), the product contains:

Identification	Chemical name/Classification	Concentration
CAS: 64-19-7	**Acetic acid** Flam. Liq. 3: H226; Met. Corr. 1: H290; Skin Corr. 1A: H314 - Danger 	**60 - <100 %**

To obtain more information on the hazards of the substances consult sections 11, 12 and 16.

SECTION 4: FIRST AID MEASURES

4.1 Description of necessary first aid measures:

Request medical assistance immediately, showing the SDS of this product.

By inhalation:

This product does not contain substances classified as hazardous for inhalation, however, in case of symptoms of intoxication remove the person affected from the exposure area and provide with fresh air. Seek medical attention if the symptoms get worse or persist.

By skin contact:

Remove contaminated clothing and footwear, rinse skin or shower the person affected if appropriate with plenty of cold water and neutral soap. In serious cases see a doctor. If the product causes burns or freezing, clothing should not be removed as this could worsen the injury caused if it is stuck to the skin. If blisters form on the skin, these should never be burst as this will increase the risk of infection.

By eye contact:

Rinse eyes thoroughly with lukewarm water for at least 15 minutes. Do not allow the person affected to rub or close their eyes. If the injured person uses contact lenses, these should be removed unless they are stuck to the eyes, as this could cause further damage. In all cases, after cleaning, a doctor should be consulted as quickly as possible with the SDS of the product.

By ingestion/aspiration:

Request immediate medical assistance, showing the SDS of this product. Do not induce vomiting, because its expulsion from the stomach can be hazardous to the mucus of the main digestive tract, and its inhalation, to the respiratory system. Rinse out the mouth and throat, as they may have been affected during ingestion. In the case of loss of consciousness do not administrate anything orally unless supervised by a doctor. Keep the person affected at rest.

4.2 Symptoms caused by exposure:

Acute and delayed effects are indicated in sections 2 and 11.

4.3 Medical attention and special treatment:

Not available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable extinguishing equipment:

Suitable extinguishing media:

Foam extinguisher (AB), Dry Chemical Powder (ABC) Fire Extinguisher, Carbon dioxide extinguisher (BC)

Unsuitable extinguishing media:

Water jet

5.2 Specific hazards arising from the chemical:

As a result of combustion or thermal decomposition reactive sub-products are created that can become highly toxic and, consequently, can present a serious health risk.

5.3 Special protective equipment and precautions for fire fighters:

Depending on the magnitude of the fire it may be necessary to use full protective clothing and individual respiratory equipment. Minimum emergency facilities and equipment should be available (fire blankets, portable first aid kit,...)

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SECTION 5: FIREFIGHTING MEASURES (continued)

Additional provisions:

Act in accordance with the Internal Emergency Plan and the Information Sheets on actions to take after an accident or other emergencies. Destroy any source of ignition. In case of fire, refrigerate the storage containers and tanks for products susceptible to inflammation, explosion or BLEVE as a result of high temperatures. Avoid spillage of the products used to extinguish the fire into an aqueous medium.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures:

For non-emergency personnel:

Isolate leaks provided that there is no additional risk for the people performing this task. Evacuate the area and keep out those without protection. Personal protection equipment must be used against potential contact with the spilt product (See section 8). Above all prevent the formation of any vapour-air flammable mixtures, through either ventilation or the use of an inert medium. Remove any source of ignition. Eliminate electrostatic charges by interconnecting all the conductive surfaces on which static electricity could form, and also ensuring that all surfaces are connected to the ground.

For emergency responders:

Wear protective equipment. Keep unprotected persons away. See section 8.

6.2 Environmental precautions:

This product is not classified as hazardous to the environment. Keep product away from drains, surface and underground water.

6.3 Methods and materials for containment and cleaning up:

It is recommended:

Absorb the spillage using sand or inert absorbent and move it to a safe place. Do not absorb in sawdust or other combustible absorbents. For any concern related to disposal consult section 13.

6.4 Reference to other sections:

See sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling:

A.- General precautions for safe use

Comply with the current legislation concerning the prevention of industrial risks. Control spills and residues, destroying them with safe methods (section 6). Avoid leakages from the container. Maintain order and cleanliness where dangerous products are used. KEEP ONLY IN ORIGINAL CONTAINER.

B.- Technical recommendations for the prevention of fires and explosions

Avoid the evaporation of the product as it contains flammable substances, which could form flammable vapour/air mixtures in the presence of sources of ignition. Control sources of ignition (mobile phones, sparks,...) and transfer at slow speeds to avoid the creation of electrostatic charges. Consult section 10 for conditions and materials that should be avoided.

C.- Technical recommendations on general occupational hygiene

Do not eat or drink during the process, washing hands afterwards with suitable cleaning products.

D.- Technical recommendations to prevent environmental risks

It is recommended to have absorbent material available at close proximity to the product (See subsection 6.3)

7.2 Conditions for safe storage, including any incompatibilities:

A.- Specific storage requirements

Minimum Temp.:	5 ºC
Maximum Temp.:	40 ºC
Maximum time:	6 Months

B.- General conditions for storage

Avoid sources of heat, radiation, static electricity and contact with food. For additional information see subsection 10.5

7.3 Specific end use(s):

Except for the instructions already specified it is not necessary to provide any special recommendation regarding the uses of this product.

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SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 Exposure control measures:

Substances whose occupational exposure limits have to be monitored in the workplace:

Workplace Exposure Standards for Airborne Contaminants 01/10/2022:

Identification	Occupational exposure limits		
Acetic acid	TWA	10 ppm	25 mg/m³
CAS: 64-19-7	STEL	15 ppm	37 mg/m³

8.2 Engineering controls:

A.- Individual protection measures, for example personal protective equipment (PPE)

As a preventative measure it is recommended to use basic Personal Protection Equipment. For more information on Personal Protection Equipment (storage, use, cleaning, maintenance, class of protection,…) consult the information leaflet provided by the manufacturer. For more information see subsection 7.1.
All information contained herein is a recommendation which needs some specification from the labour risk prevention services as it is not known whether the company has additional measures at its disposal.

B.- Respiratory protection

The use of protection equipment will be necessary if a mist forms or if the occupational exposure limits are exceeded.

C.- Specific protection for the hands

Pictogram	PPE	Remarks
 Mandatory hand protection	Chemical protective gloves (Material: Viton®-Butyl, Breakthrough time: > 480 min, Thickness: 0.7 mm)	Replace the gloves at any sign of deterioration.

As the product is a mixture of several substances, the resistance of the glove material can not be calculated in advance with total reliability and has therefore to be checked prior to the application.

D.- Eye and face protection

Pictogram	PPE	Remarks
 Mandatory face protection	Face shield	Clean daily and disinfect periodically according to the manufacturer´s instructions. Use if there is a risk of splashing.

E.- Bodily protection

Pictogram	PPE	Remarks
 Mandatory complete body protection	Disposable clothing for protection against chemical risks	For professional use only. Clean periodically according to the manufacturer´s instructions.
 Mandatory foot protection	Safety footwear for protection against chemical risk	Replace boots at any sign of deterioration.

F.- Additional emergency measures

Emergency measure	Standards	Emergency measure	Standards
 Emergency shower	ANSI Z358-1 ISO 3864-1:2011, ISO 3864-4:2011	 Eyewash stations	DIN 12 899 ISO 3864-1:2011, ISO 3864-4:2011

Environmental exposure controls:

In accordance with the community legislation for the protection of the environment it is recommended to avoid environmental spillage of both the product and its container. For additional information see subsection 7.1.D

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SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties:

For complete information see the product datasheet.

Appearance:

Physical state at 20 ºC:	Liquid
Appearance:	Colorless
Color:	Colourless
Odor:	Pungent
Odour threshold:	Not available *

Volatility:

Boiling point at atmospheric pressure:	113 ºC
Vapour pressure at 20 ºC:	1980 Pa
Vapour pressure at 50 ºC:	10087.82 Pa (10.09 kPa)
Evaporation rate at 20 ºC:	Not available *

Product description:

Density at 20 ºC:	1044.1 kg/m³
Relative density at 20 ºC:	1.044
Dynamic viscosity at 20 ºC:	1.13 cP
Kinematic viscosity at 20 ºC:	1.08 mm²/s
Kinematic viscosity at 40 ºC:	Not available *
Concentration:	Not available *
pH:	0.5 - 2.9
Vapour density at 20 ºC:	Not available *
Partition coefficient n-octanol/water 20 ºC:	Not available *
Solubility in water at 20 ºC:	Infinitely soluble
Solubility properties:	Water-soluble
Decomposition temperature:	Not available *
Melting point/freezing point:	Not available *

Flammability:

Flash Point:	67 ºC
Flammability (solid, gas):	Not available *
Autoignition temperature:	427 ºC
Lower flammability limit:	Not available *
Upper flammability limit:	Not available *

Particle characteristics:

Median equivalent diameter:	Non-applicable

9.2 Other information:

Information with regard to physical hazard classes:

Explosive properties:	Not available *
Oxidising properties:	Not available *
Corrosive to metals:	H290 May be corrosive to metals.
Heat of combustion:	Not available *
Aerosols-total percentage (by mass) of flammable components:	Not available *

Other safety characteristics:

Surface tension at 20 ºC:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

Refraction index: Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity:

No hazardous reactions are expected because the product is stable under recommended storage conditions. See section 7 from Safety Data Sheet.

10.2 Chemical stability:

Chemically stable under the indicated conditions of storage, handling and use.

10.3 Possibility of hazardous reactions:

Under the specified conditions, hazardous reactions that lead to excessive temperatures or pressure are not expected.

10.4 Conditions to avoid:

Applicable for handling and storage at room temperature:

Shock and friction	Contact with air	Increase in temperature	Sunlight	Humidity
Not applicable	Not applicable	Risk of combustion	Avoid direct impact	Not applicable

10.5 Incompatible materials:

Acids	Water	Oxidising materials	Combustible materials	Others
Not applicable	Not applicable	Precaution	Not applicable	Avoid alkalis or strong bases

10.6 Hazardous decomposition products:

See subsection 10.3, 10.4 and 10.5 to find out the specific decomposition products. Depending on the decomposition conditions, complex mixtures of chemical substances can be released: carbon dioxide (CO_2), carbon monoxide and other organic compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects:

The experimental information related to the toxicological properties of the product itself is not available

Dangerous health implications:

In case of exposure that is repetitive, prolonged or at concentrations higher than recommended by the occupational exposure limits, it may result in adverse effects on health depending on the means of exposure:

A- Ingestion (acute effect):

- Acute toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for consumption. For more information see section 3
- Corrosivity/Irritability: Corrosive product, if it is swallowed causes burns destroying the tissues. For more information about secondary effects from skin contact see section 2.

B- Inhalation (acute effect):

- Acute toxicity : Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for inhalation. For more information see section 3.
- Corrosivity/Irritability: Prolonged inhalation of the product is corrosive to mucous membranes and the upper respiratory tract

C- Contact with the skin and the eyes (acute effect):

- Contact with the skin: Above all, skin contact may occur as fabrics of all thicknesses can be destroyed, resulting in burns. For more information on the secondary effects see section 2.
- Contact with the eyes: Produces serious eye damage after contact.

D- CMR effects (carcinogenicity, mutagenicity and toxicity to reproduction):

- Carcinogenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for the effects mentioned. For more information see section 3.
  IARC: Not available
- Mutagenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Reproductive toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

E- Sensitizing effects:

- CONTINUED ON NEXT PAGE -

SECTION 11: TOXICOLOGICAL INFORMATION (continued)

- Respiratory: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous with sensitising effects. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

F- Specific target organ toxicity (STOT) - single exposure:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

G- Specific target organ toxicity (STOT)-repeated exposure:

- Specific target organ toxicity (STOT)-repeated exposure: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

H- Aspiration hazard:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

Other information:

Not available

Specific toxicology information on the substances:

Not available

SECTION 12: ECOLOGICAL INFORMATION

The experimental information related to the eco-toxicological properties of the product itself is not available

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

12.1 Ecotoxicity:

Acute toxicity:

Identification	Concentration		Species	Genus
Acetic acid	LC50	75 mg/L (96 h)	Lepomis macrochirus	Fish
CAS: 64-19-7	EC50	47 mg/L (24 h)	Daphnia magna	Crustacean
	EC50	Not available		

Chronic toxicity:

Identification	Concentration		Species	Genus
Acetic acid	NOEC	57.2 mg/L	Oncorhynchus mykiss	Fish
CAS: 64-19-7	NOEC	80 mg/L	Daphnia magna	Crustacean

12.2 Persistence and degradability:

Substance-specific information:

Identification	Degradability		Biodegradability	
Acetic acid	BOD5	Not available	Concentration	100 mg/L
CAS: 64-19-7	COD	Not available	Period	14 days
	BOD5/COD	Not available	% Biodegradable	74 %

12.3 Bioaccumulative potential:

Substance-specific information:

Identification	Bioaccumulation potential	
Acetic acid	BCF	3
CAS: 64-19-7	Pow Log	-0.71
	Potential	Low

12.4 Mobility in soil:

- CONTINUED ON NEXT PAGE -

SECTION 12: ECOLOGICAL INFORMATION (continued)

Identification	Absorption/desorption		Volatility	
Acetic acid	Koc	Not available	Henry	Not available
CAS: 64-19-7	Conclusion	Not available	Dry soil	Not available
	Surface tension	2.699E-2 N/m (25 ºC)	Moist soil	Not available

12.5 Results of PBT and vPvB assessment:

Non-applicable

12.6 Other adverse effects:

Not described

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Disposal methods:

Waste management (disposal and evaluation):

Consult the authorized waste service manager on the assessment and disposal operations. In case the container has been in direct contact with the product, it will be processed the same way as the actual product. Otherwise, it will be processed as non-hazardous residue. Waste should not be disposed of to drains. See epigraph 6.2.

Regulations related to waste management:

Legislation related to waste management:

Basel Convention (Hazardous Waste)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 and Amendments

SECTION 14: TRANSPORT INFORMATION

Transport of dangerous goods by land:

With regard to ADG Code:

14.1	**UN number:**	UN2790
14.2	**Proper shipping name or Technical Name:**	ACETIC ACID SOLUTION
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	II
14.5	**Environmental hazards for Transport Purposes:**	No
14.6	**Special precautions for user**	
	Physico-Chemical properties:	see section 9
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

Transport of dangerous goods by sea:

With regard to IMDG 41-22:

- CONTINUED ON NEXT PAGE -

SECTION 14: TRANSPORT INFORMATION (continued)

14.1	**UN number:**	UN2790
14.2	**Proper shipping name or Technical Name:**	ACETIC ACID SOLUTION
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	II
14.5	**Marine pollutant:**	No
14.6	**Special precautions for user**	
	Special regulations:	Not available
	EmS Codes:	F-A, S-B
	Physico-Chemical properties:	see section 9
	Limited quantities:	1 L
	Segregation group:	SGG1
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

Transport of dangerous goods by air:

With regard to IATA/ICAO 2024:

14.1	**UN number:**	UN2790
14.2	**Proper shipping name or Technical Name:**	ACETIC ACID SOLUTION
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	II
14.5	**Environmental hazards for Transport Purposes:**	No
14.6	**Special precautions for user**	
	Physico-Chemical properties:	see section 9
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations:

Specific provisions in terms of protecting people or the environment:

It is recommended to use the information included in this safety data sheet as data used in a risk evaluation of the local circumstances in order to establish the necessary risk prevention measures for the manipulation, use, storage and disposal of this product.

Industrial Chemicals Act 2019:

Industrial Chemicals (Notification and Assessment) Act 1989

SECTION 16: OTHER INFORMATION

Legislation related to safety data sheets:
This safety data sheet has been designed in accordance with WHS regulations and Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Texts of the legislative phrases mentioned in section 2:
H290: May be corrosive to metals.
H318: Causes serious eye damage.
H227: Combustible liquid.
H314: Causes severe skin burns and eye damage.

Texts of the legislative phrases mentioned in section 3:
The phrases indicated do not refer to the product itself; they are present merely for informative purposes and refer to the individual components which appear in section 3

WHS:

- CONTINUED ON NEXT PAGE -

SECTION 16: OTHER INFORMATION (continued)

Flam. Liq. 3: H226 - Flammable liquid and vapour.
Met. Corr. 1: H290 - May be corrosive to metals.
Skin Corr. 1A: H314 - Causes severe skin burns and eye damage.

Advice related to training:

Minimal training is recommended to prevent industrial risks for staff using this product, in order to facilitate their comprehension and interpretation of this safety data sheet, as well as the label on the product.

Principal bibliographical sources:

http://www.safeworkaustralia.gov.au/

Abbreviations and acronyms:

ADG: Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG: International maritime dangerous goods code
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
COD: Chemical Oxygen Demand
BOD5: 5-day biochemical oxygen demand
BCF: Bioconcentration factor
LD50: Lethal Dose 50
CL50: Lethal Concentration 50
EC50: Effective concentration 50
Log-POW: Octanol-water partition coefficient
Koc: Partition coefficient of organic carbon
IARC: International Agency for Research on Cancer

END OF SAFETY DATA SHEET

SECTION 1: IDENTIFICATION

1.1 Product identifier: BHE-01F

Other means of identification:

Not available

1.2 Recommended use of the chemical and restrictions on use:

Relevant uses: Oxidant. For professional users only.

Uses advised against: All uses not specified in this section or in section 7.3

1.3 Details of manufacturer or importer:

Fusion Technologies (Australia) Pty
Unit 3, 1472 Boundary Road
Wacol , Queensland 4076, Australia
Phone: +61 460 047 656
https://www.fusiontechinc.net/

Technical Inquries: help@fusiontechinc.net

1.4 Emergency phone number: **AU 1800 033 111 NZ 0800 734 607 (ALL HOURS)**

SECTION 2: HAZARD(S) IDENTIFICATION

2.1 Classification of the hazardous chemical:

WHS:

Classification of this product has been carried out in accordance with Model Work Health and Safety Regulations(Hazardous Chemicals) Amendment 2022

Acute Tox. 4: Acute toxicity if swallowed, Category 4, H302
Eye Irrit. 2A: Eye irritation, Category 2A, H319
Ox. Sol. 3: Oxidising Solid, Category 3 , H272
Resp. Sens. 1: Sensitisation, respiratory, Category 1, H334
Skin Irrit. 2: Skin irritation, Category 2, H315
Skin Sens. 1: Sensitisation, skin, Category 1, H317
STOT SE 3: Respiratory tract toxicity, single exposure, Category 3, H335

2.2 Label elements, including precautionary statements:

WHS:

Danger

Hazard statements:

Acute Tox. 4: H302 - Harmful if swallowed.
Eye Irrit. 2A: H319 - Causes serious eye irritation.
Ox. Sol. 3: H272 - May intensify fire, oxidizer.
Resp. Sens. 1: H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled.
Skin Irrit. 2: H315 - Causes skin irritation.
Skin Sens. 1: H317 - May cause an allergic skin reaction.
STOT SE 3: H335 - May cause respiratory irritation.

Precautionary statements:

P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P280: Wear protective gloves/face protection/protective clothing/respiratory protection/protective footwear.
P302+P352: IF ON SKIN: Wash with plenty of soap and water.
P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P342+P311: If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.
P370+P378: In case of fire: Use Water to extinguish.
P501: Dispose of contents and / or containers in accordance with regulations on hazardous waste or packaging and packaging waste respectively.

Substances that contribute to the classification

Ammonium persulphate (60 - <100 %)

2.3 Other hazards which do not result in classification:

- CONTINUED ON NEXT PAGE -

SECTION 2: HAZARD(S) IDENTIFICATION (continued)

Not available

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

3.1 Substances:

Non-applicable

3.2 Mixtures:

Chemical description: Mixture of substances

Components:

In accordance with Schedule 8 (WHS Regulations), the product contains:

Identification	Chemical name/Classification	Concentration
CAS: 7727-54-0	**Ammonium persulphate** Acute Tox. 4: H302; Eye Irrit. 2A: H319; Ox. Sol. 3: H272; Resp. Sens. 1: H334; Skin Irrit. 2: H315; Skin Sens. 1: H317; STOT SE 3: H335 - Danger	**60 - <100 %**

To obtain more information on the hazards of the substances consult sections 11, 12 and 16.

SECTION 4: FIRST AID MEASURES

4.1 Description of necessary first aid measures:

The symptoms resulting from intoxication can appear after exposure, therefore, in case of doubt, seek medical attention for direct exposure to the chemical product or persistent discomfort, showing the SDS of this product.

By inhalation:

Remove the person affected from the area of exposure, provide with fresh air and keep at rest. In serious cases such as cardiorespiratory failure, artificial resuscitation techniques will be necessary (mouth to mouth resuscitation, cardiac massage, oxygen supply, etc.) requiring immediate medical assistance.

By skin contact:

Remove contaminated clothing and footwear, rinse skin or shower the person affected if appropriate with plenty of cold water and neutral soap. In serious cases see a doctor. If the product causes burns or freezing, clothing should not be removed as this could worsen the injury caused if it is stuck to the skin. If blisters form on the skin, these should never be burst as this will increase the risk of infection.

By eye contact:

Rinse eyes thoroughly with lukewarm water for at least 15 minutes. Do not allow the person affected to rub or close their eyes. If the injured person uses contact lenses, these should be removed unless they are stuck to the eyes, as this could cause further damage. In all cases, after cleaning, a doctor should be consulted as quickly as possible with the SDS of the product.

By ingestion/aspiration:

Request medical assistance immediately, showing the SDS of this product. Do not induce vomiting, but if it does happen keep the head down to avoid aspiration. In the case of loss of consciousness do not administrate anything orally unless supervised by a doctor. Rinse out the mouth and throat, as they may have been affected during ingestion. Keep the person affected at rest.

4.2 Symptoms caused by exposure:

Acute and delayed effects are indicated in sections 2 and 11.

4.3 Medical attention and special treatment:

Not available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable extinguishing equipment:

Suitable extinguishing media:

Water

Unsuitable extinguishing media:

Foam extinguisher (AB), Dry Chemical Powder (ABC) Fire Extinguisher

5.2 Specific hazards arising from the chemical:

- CONTINUED ON NEXT PAGE -

SECTION 5: FIREFIGHTING MEASURES (continued)

As a result of combustion or thermal decomposition reactive sub-products are created that can become highly toxic and, consequently, can present a serious health risk.

Oxidizer. Releases oxygen to create an oxygen-rich atmosphere. Will cause combustible materials to ignite more readily.

5.3 Special protective equipment and precautions for fire fighters:

Depending on the magnitude of the fire it may be necessary to use full protective clothing and individual respiratory equipment. Minimum emergency facilities and equipment should be available (fire blankets, portable first aid kit,...)

Additional provisions:

Act in accordance with the Internal Emergency Plan and the Information Sheets on actions to take after an accident or other emergencies. Destroy any source of ignition. In case of fire, refrigerate the storage containers and tanks for products susceptible to inflammation, explosion or BLEVE as a result of high temperatures. Avoid spillage of the products used to extinguish the fire into an aqueous medium.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures:

For non-emergency personnel:

MAY INTENSIFY FIRE, OXIDISER. Sweep up and shovel product or other means and place in container for reuse (preferred) or disposal. Remove any source of ignition. Eliminate electrostatic charges by interconnecting all the conductive surfaces on which static electricity could form, and also ensuring that all surfaces are connected to the ground.

For emergency responders:

Wear protective equipment. Keep unprotected persons away. See section 8.

6.2 Environmental precautions:

This product is not classified as hazardous to the environment. Keep product away from drains, surface and underground water.

6.3 Methods and materials for containment and cleaning up:

It is recommended:

Preferably use aspiration for cleaning. Given the danger of the product by inhalation, any cleaning method that involves exposure to the product in this way (sweeping, etc.) is not recommended

6.4 Reference to other sections:

See sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling:

A.- General precautions for safe use

Comply with the current legislation concerning the prevention of industrial risks. Keep containers hermetically sealed. Control spills and residues, destroying them with safe methods (section 6). Avoid leakages from the container. Maintain order and cleanliness where dangerous products are used.

B.- Technical recommendations for the prevention of fires and explosions

AVOID ANY IGNITION SOURCE, as well as combustible and/or inflammable material. Devices and systems must comply with the essential safety and health requirements and, with the minimum requirements for improving the health and safety protection of workers. Consult section 10 for conditions and materials that should be avoided.

C.- Technical recommendations on general occupational hygiene

Do not eat or drink during the process, washing hands afterwards with suitable cleaning products.

D.- Technical recommendations to prevent environmental risks

None specific.

7.2 Conditions for safe storage, including any incompatibilities:

A.- Specific storage requirements

Minimum Temp.:	5 ºC
Maximum Temp.:	40 ºC
Maximum time:	6 Months

B.- General conditions for storage

Avoid sources of heat, radiation, static electricity and contact with food. For additional information see subsection 10.5

- CONTINUED ON NEXT PAGE -

SECTION 7: HANDLING AND STORAGE (continued)

7.3 Specific end use(s):

Except for the instructions already specified it is not necessary to provide any special recommendation regarding the uses of this product.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 Exposure control measures:

Substances whose occupational exposure limits have to be monitored in the workplace:

Workplace Exposure Standards for Airborne Contaminants 01/10/2022:

Identification	Occupational exposure limits		
Ammonium persulphate	TWA		0.01 mg/m³
CAS: 7727-54-0	STEL		

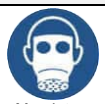
Nuisance dust: Inhalable dust 10 mg/m3 // Respirable dust 4 mg/m3

8.2 Engineering controls:

A.- Individual protection measures, for example personal protective equipment (PPE)

As a preventative measure it is recommended to use basic Personal Protection Equipment. For more information on Personal Protection Equipment (storage, use, cleaning, maintenance, class of protection,…) consult the information leaflet provided by the manufacturer. For more information see subsection 7.1.
All information contained herein is a recommendation which needs some specification from the labour risk prevention services as it is not known whether the company has additional measures at its disposal.

B.- Respiratory protection

Pictogram	PPE	Remarks
 Mandatory respiratory tract protection	Filter mask for gases, vapours and particles	Replace when an increase in resistence to breathing is observed and/or a smell or taste of the contaminant is detected.

C.- Specific protection for the hands

Pictogram	PPE	Remarks
 Mandatory hand protection	Chemical protective gloves (Material: Butyl, Breakthrough time: > 480 min)	Replace the gloves at any sign of deterioration.

As the product is a mixture of several substances, the resistance of the glove material can not be calculated in advance with total reliability and has therefore to be checked prior to the application.

D.- Eye and face protection

Pictogram	PPE	Remarks
 Mandatory face protection	Face shield	Clean daily and disinfect periodically according to the manufacturer´s instructions. Use if there is a risk of splashing.

E.- Bodily protection

Pictogram	PPE	Remarks
 Mandatory complete body protection	Disposable clothing for protection against chemical risks	For professional use only. Clean periodically according to the manufacturer´s instructions.

- CONTINUED ON NEXT PAGE -

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION (continued)

Pictogram	PPE	Remarks
 Mandatory foot protection	Safety footwear for protection against chemical risk	Replace boots at any sign of deterioration.

F.- Additional emergency measures

Emergency measure	Standards	Emergency measure	Standards
 Emergency shower	ANSI Z358-1 ISO 3864-1:2011, ISO 3864-4:2011	 Eyewash stations	DIN 12 899 ISO 3864-1:2011, ISO 3864-4:2011

Environmental exposure controls:

In accordance with the community legislation for the protection of the environment it is recommended to avoid environmental spillage of both the product and its container. For additional information see subsection 7.1.D

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties:

For complete information see the product datasheet.

Appearance:

Physical state at 20 ºC:	Solid
Appearance:	Granulated
Color:	Cream
Odor:	Mild
Odour threshold:	Not available *

Volatility:

Boiling point at atmospheric pressure:	Not available *
Vapour pressure at 20 ºC:	Not available *
Vapour pressure at 50 ºC:	Not available *
Evaporation rate at 20 ºC:	Not available *

Product description:

Density at 20 ºC:	1594 kg/m³
Relative density at 20 ºC:	1.8
Dynamic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 40 ºC:	Not available *
Concentration:	Not available *
pH:	7.2
Vapour density at 20 ºC:	Not available *
Partition coefficient n-octanol/water 20 ºC:	Not available *
Solubility in water at 20 ºC:	Not available *
Solubility properties:	Partially water-soluble
Decomposition temperature:	Not available *
Melting point/freezing point:	Not available *

Flammability:

Flash Point:	121 ºC
Flammability (solid, gas):	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

Autoignition temperature:	Not available *
Lower flammability limit:	Not available *
Upper flammability limit:	Not available *
Explosive (Solid):	
Lower explosive limit:	Not available *
Upper explosive limit:	Not available *
Particle characteristics:	
Median equivalent diameter:	Not available *

9.2 Other information:

Information with regard to physical hazard classes:

Explosive properties:	Not available *
Oxidising properties:	H272 May intensify fire, oxidizer.
Corrosive to metals:	Not available *
Heat of combustion:	Not available *
Aerosols-total percentage (by mass) of flammable components:	Not available *
Other safety characteristics:	
Surface tension at 20 ºC:	Not available *
Refraction index:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity:

No hazardous reactions are expected because the product is stable under recommended storage conditions. See section 7 from Safety Data Sheet.

10.2 Chemical stability:

Chemically stable under the indicated conditions of storage, handling and use.

10.3 Possibility of hazardous reactions:

Under the specified conditions, hazardous reactions that lead to excessive temperatures or pressure are not expected.

10.4 Conditions to avoid:

Applicable for handling and storage at room temperature:

Shock and friction	Contact with air	Increase in temperature	Sunlight	Humidity
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

10.5 Incompatible materials:

Acids	Water	Oxidising materials	Combustible materials	Others
Avoid strong acids	Not applicable	Not applicable	Avoid direct impact	Avoid alkalis or strong bases

10.6 Hazardous decomposition products:

See subsection 10.3, 10.4 and 10.5 to find out the specific decomposition products. Depending on the decomposition conditions, complex mixtures of chemical substances can be released: carbon dioxide (CO_2), carbon monoxide and other organic compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects:

The experimental information related to the toxicological properties of the product itself is not available

Dangerous health implications:

In case of exposure that is repetitive, prolonged or at concentrations higher than recommended by the occupational exposure limits, it may result in adverse effects on health depending on the means of exposure:

- CONTINUED ON NEXT PAGE -

SECTION 11: TOXICOLOGICAL INFORMATION (continued)

A- Ingestion (acute effect):

- Acute toxicity: The consumption of a considerable dose can cause irritation in the throat, abdominal pain, nausea and vomiting.
- Corrosivity/Irritability: The consumption of a considerable dose can cause irritation in the throat, abdominal pain, nausea and vomiting.

B- Inhalation (acute effect):

- Acute toxicity : Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for inhalation. For more information see section 3.
- Corrosivity/Irritability: Causes irritation in respiratory passages, which is normally reversible and limited to the upper respiratory passages.

C- Contact with the skin and the eyes (acute effect):

- Contact with the skin: Produces skin inflammation.
- Contact with the eyes: Produces eye irritation after contact.

D- CMR effects (carcinogenicity, mutagenicity and toxicity to reproduction):

- Carcinogenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for the effects mentioned. For more information see section 3.
  IARC: Talc (3)
- Mutagenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Reproductive toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

E- Sensitizing effects:

- Respiratory: Prolonged exposure can result in specific respiratory hypersensitivity.
- Skin: Prolonged contact with the skin can result in episodes of allergic contact dermatitis.

F- Specific target organ toxicity (STOT) - single exposure:

Causes irritation in respiratory passages, which is normally reversible and limited to the upper respiratory passages.

G- Specific target organ toxicity (STOT)-repeated exposure:

- Specific target organ toxicity (STOT)-repeated exposure: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

H- Aspiration hazard:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

Other information:

Not available

Specific toxicology information on the substances:

Identification	Acute toxicity		Genus
Ammonium persulphate	LD50 oral	689 mg/kg (ATEi)	Rat
CAS: 7727-54-0	LD50 dermal		
	LC50 inhalation		

SECTION 12: ECOLOGICAL INFORMATION

The experimental information related to the eco-toxicological properties of the product itself is not available

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

12.1 Ecotoxicity:

Acute toxicity:

Identification	Concentration		Species	Genus
Ammonium persulphate	LC50	76 mg/L (96 h)	Oncorhynchus mykiss	Fish
CAS: 7727-54-0	EC50	120 mg/L (48 h)	Daphnia magna	Crustacean
	EC50	Not available		

- CONTINUED ON NEXT PAGE -

SECTION 12: ECOLOGICAL INFORMATION (continued)

Chronic toxicity:

Identification	Concentration		Species	Genus
Ammonium persulphate	NOEC	Not available		
CAS: 7727-54-0	NOEC	20.8 mg/L	Daphnia magna	Crustacean

12.2 Persistence and degradability:

Not available

12.3 Bioaccumulative potential:

Not available

12.4 Mobility in soil:

Not available

Partially water-soluble

12.5 Results of PBT and vPvB assessment:

Non-applicable

12.6 Other adverse effects:

Not described

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Disposal methods:

Waste management (disposal and evaluation):

Consult the authorized waste service manager on the assessment and disposal operations. In case the container has been in direct contact with the product, it will be processed the same way as the actual product. Otherwise, it will be processed as non-hazardous residue. Waste should not be disposed of to drains. See epigraph 6.2.

Regulations related to waste management:

Legislation related to waste management:

Basel Convention (Hazardous Waste)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 and Amendments

SECTION 14: TRANSPORT INFORMATION

Transport of dangerous goods by land:

With regard to ADG Code:

14.1	**UN number:**	UN1479
14.2	**Proper shipping name or Technical Name:**	OXIDIZING SOLID, N.O.S. (Ammonium persulphate)
14.3	**Transport hazard class:**	5.1
	Labels:	5.1
14.4	**Packing Group:**	III
14.5	**Environmental hazards for Transport Purposes:**	No
14.6	**Special precautions for user**	
	Physico-Chemical properties:	see section 9
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

Transport of dangerous goods by sea:

With regard to IMDG 41-22:

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SECTION 14: TRANSPORT INFORMATION (continued)

14.1	**UN number:**	UN1479
14.2	**Proper shipping name or Technical Name:**	OXIDIZING SOLID, N.O.S. (Ammonium persulphate)
14.3	**Transport hazard class:**	5.1
	Labels:	5.1
14.4	**Packing Group:**	III
14.5	**Marine pollutant:**	No
14.6	**Special precautions for user**	
	Special regulations:	223, 274, 900
	EmS Codes:	F-A, S-Q
	Physico-Chemical properties:	see section 9
	Limited quantities:	5 kg
	Segregation group:	Not available
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

Transport of dangerous goods by air:

With regard to IATA/ICAO 2024:

14.1	**UN number:**	UN1479
14.2	**Proper shipping name or Technical Name:**	OXIDIZING SOLID, N.O.S. (Ammonium persulphate)
14.3	**Transport hazard class:**	5.1
	Labels:	5.1
14.4	**Packing Group:**	III
14.5	**Environmental hazards for Transport Purposes:**	No
14.6	**Special precautions for user**	
	Physico-Chemical properties:	see section 9
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations:

Specific provisions in terms of protecting people or the environment:

It is recommended to use the information included in this safety data sheet as data used in a risk evaluation of the local circumstances in order to establish the necessary risk prevention measures for the manipulation, use, storage and disposal of this product.

Industrial Chemicals Act 2019:

Industrial Chemicals (Notification and Assessment) Act 1989

SECTION 16: OTHER INFORMATION

Legislation related to safety data sheets:
This safety data sheet has been designed in accordance with WHS regulations and Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Texts of the legislative phrases mentioned in section 2:
H272: May intensify fire, oxidizer.
H315: Causes skin irritation.
H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H317: May cause an allergic skin reaction.
H335: May cause respiratory irritation.
H302: Harmful if swallowed.
H319: Causes serious eye irritation.

Texts of the legislative phrases mentioned in section 3:
The phrases indicated do not refer to the product itself; they are present merely for informative purposes and refer to the individual components which appear in section 3

- CONTINUED ON NEXT PAGE -

SECTION 16: OTHER INFORMATION (continued)

WHS:

Acute Tox. 4: H302 - Harmful if swallowed.
Eye Irrit. 2A: H319 - Causes serious eye irritation.
Ox. Sol. 3: H272 - May intensify fire, oxidizer.
Resp. Sens. 1: H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled.
Skin Irrit. 2: H315 - Causes skin irritation.
Skin Sens. 1: H317 - May cause an allergic skin reaction.
STOT SE 3: H335 - May cause respiratory irritation.

Advice related to training:

Minimal training is recommended to prevent industrial risks for staff using this product, in order to facilitate their comprehension and interpretation of this safety data sheet, as well as the label on the product.

Principal bibliographical sources:

http://www.safeworkaustralia.gov.au/

Abbreviations and acronyms:

ADG: Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG: International maritime dangerous goods code
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
COD: Chemical Oxygen Demand
BOD5: 5-day biochemical oxygen demand
BCF: Bioconcentration factor
LD50: Lethal Dose 50
CL50: Lethal Concentration 50
EC50: Effective concentration 50
Log-POW: Octanol-water partition coefficient
Koc: Partition coefficient of organic carbon
IARC: International Agency for Research on Cancer

END OF SAFETY DATA SHEET

SECTION 1: IDENTIFICATION

1.1 Product identifier: BIO-GQ510

Other means of identification:

Not available

1.2 Recommended use of the chemical and restrictions on use:

Relevant uses: Biocide . For professional users only.

Uses advised against: All uses not specified in this section or in section 7.3

1.3 Details of manufacturer or importer:

Fusion Technologies (Australia) Pty
Unit 3, 1472 Boundary Road
Wacol, Queensland 4076, Australia
Phone: +61 460 047 656
https://www.fusiontechinc.net/

Technical Inquries: help@fusiontechinc.net

1.4 Emergency phone number: **AU 1800 033 111 NZ 0800 734 607 (ALL HOURS)**

SECTION 2: HAZARD(S) IDENTIFICATION

2.1 Classification of the hazardous chemical:

WHS:

Classification of this product has been carried out in accordance with Model Work Health and Safety Regulations(Hazardous Chemicals) Amendment 2022

Eye Dam. 1: Serious eye damage, Category 1, H318
Resp. Sens. 1: Sensitisation, respiratory, Category 1, H334
Skin Corr. 1B: Skin corrosion, Category 1B, H314
Skin Sens. 1: Sensitisation, skin, Category 1, H317
STOT SE 3: Respiratory tract toxicity, single exposure, Category 3, H335

2.2 Label elements, including precautionary statements:

WHS:

Danger

Hazard statements:

Resp. Sens. 1: H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled.
Skin Corr. 1B: H314 - Causes severe skin burns and eye damage.
Skin Sens. 1: H317 - May cause an allergic skin reaction.
STOT SE 3: H335 - May cause respiratory irritation.

Precautionary statements:

P280: Wear protective gloves/face protection/protective clothing/respiratory protection/protective footwear.
P301+P330+P331: IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P302+P352: IF ON SKIN: Wash with plenty of soap and water.
P303+P361+P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P342+P311: If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.
P501: Dispose of contents and / or containers in accordance with regulations on hazardous waste or packaging and packaging waste respectively.

Substances that contribute to the classification

Glutaraldehyde (<10 %); Didecyldimethylammonium chloride (<10 %); Benzalkonium chloride (<10 %)

2.3 Other hazards which do not result in classification:

Not available

- CONTINUED ON NEXT PAGE -

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

3.1 Substances:

Non-applicable

3.2 Mixtures:

Chemical description: Biocide/s

Components:

In accordance with Schedule 8 (WHS Regulations), the product contains:

Identification	Chemical name/Classification	Concentration
CAS: 111-30-8	**Glutaraldehyde** Acute Tox. 3: H301+H331; Eye Dam. 1: H318; Met. Corr. 1: H290; Resp. Sens. 1: H334; Skin Corr. 1B: H314; Skin Sens. 1: H317 - Danger	**<10 %**
CAS: 7173-51-5	**Didecyldimethylammonium chloride** Acute Tox. 4: H302; Eye Dam. 1: H318; Skin Corr. 1B: H314 - Danger	**<10 %**
CAS: 8001-54-5	**Benzalkonium chloride** Acute Tox. 4: H302+H312; Skin Corr. 1B: H314 - Danger	**<10 %**

To obtain more information on the hazards of the substances consult sections 11, 12 and 16.

SECTION 4: FIRST AID MEASURES

4.1 Description of necessary first aid measures:

Request medical assistance immediately, showing the SDS of this product.

By inhalation:

Remove the person affected from the area of exposure, provide with fresh air and keep at rest. In serious cases such as cardiorespiratory failure, artificial resuscitation techniques will be necessary (mouth to mouth resuscitation, cardiac massage, oxygen supply, etc.) requiring immediate medical assistance.

By skin contact:

Remove contaminated clothing and footwear, rinse skin or shower the person affected if appropriate with plenty of cold water and neutral soap. In serious cases see a doctor. If the product causes burns or freezing, clothing should not be removed as this could worsen the injury caused if it is stuck to the skin. If blisters form on the skin, these should never be burst as this will increase the risk of infection.

By eye contact:

Rinse eyes thoroughly with lukewarm water for at least 15 minutes. Do not allow the person affected to rub or close their eyes. If the injured person uses contact lenses, these should be removed unless they are stuck to the eyes, as this could cause further damage. In all cases, after cleaning, a doctor should be consulted as quickly as possible with the SDS of the product.

By ingestion/aspiration:

Request immediate medical assistance, showing the SDS of this product. Do not induce vomiting, because its expulsion from the stomach can be hazardous to the mucus of the main digestive tract, and its inhalation, to the respiratory system. Rinse out the mouth and throat, as they may have been affected during ingestion. In the case of loss of consciousness do not administrate anything orally unless supervised by a doctor. Keep the person affected at rest.

4.2 Symptoms caused by exposure:

Acute and delayed effects are indicated in sections 2 and 11.

4.3 Medical attention and special treatment:

Not available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable extinguishing equipment:

Suitable extinguishing media:

Product is non-flammable under normal conditions of storage, handling and use. In the case of combustion as a result of improper handling, storage or use preferably use polyvalent powder extinguishers (ABC powder), in accordance with the Regulation on fire protection systems.

Unsuitable extinguishing media:

- CONTINUED ON NEXT PAGE -

SECTION 5: FIREFIGHTING MEASURES (continued)

Non-applicable

5.2 Specific hazards arising from the chemical:

As a result of combustion or thermal decomposition reactive sub-products are created that can become highly toxic and, consequently, can present a serious health risk.

5.3 Special protective equipment and precautions for fire fighters:

Depending on the magnitude of the fire it may be necessary to use full protective clothing and individual respiratory equipment. Minimum emergency facilities and equipment should be available (fire blankets, portable first aid kit,...)

Additional provisions:

Act in accordance with the Internal Emergency Plan and the Information Sheets on actions to take after an accident or other emergencies. Destroy any source of ignition. In case of fire, refrigerate the storage containers and tanks for products susceptible to inflammation, explosion or BLEVE as a result of high temperatures. Avoid spillage of the products used to extinguish the fire into an aqueous medium.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures:

For non-emergency personnel:

Isolate leaks provided that there is no additional risk for the people performing this task. Personal protection equipment must be used against potential contact with the spilt product (See section 8). Evacuate the area and keep out those who do not have protection.

For emergency responders:

Wear protective equipment. Keep unprotected persons away. See section 8.

6.2 Environmental precautions:

This product is not classified as hazardous to the environment. Keep product away from drains, surface and underground water.

6.3 Methods and materials for containment and cleaning up:

It is recommended:

Absorb the spillage using sand or inert absorbent and move it to a safe place. Do not absorb in sawdust or other combustible absorbents. For any concern related to disposal consult section 13.

6.4 Reference to other sections:

See sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling:

A.- General precautions for safe use

Comply with the current legislation concerning the prevention of industrial risks. Keep containers hermetically sealed. Control spills and residues, destroying them with safe methods (section 6). Avoid leakages from the container. Maintain order and cleanliness where dangerous products are used.

B.- Technical recommendations for the prevention of fires and explosions

Product is non-flammable under normal conditions of storage, manipulation and use. It is recommended to transfer at slow speeds to avoid the generation of electrostatic charges that can affect flammable products. Consult section 10 for information on conditions and materials that should be avoided.

C.- Technical recommendations on general occupational hygiene

Do not eat or drink during the process, washing hands afterwards with suitable cleaning products.

D.- Technical recommendations to prevent environmental risks

It is recommended to have absorbent material available at close proximity to the product (See subsection 6.3)

7.2 Conditions for safe storage, including any incompatibilities:

A.- Specific storage requirements

Minimum Temp.:	5 ºC
Maximum Temp.:	40 ºC
Maximum time:	6 Months

- CONTINUED ON NEXT PAGE -

SECTION 7: HANDLING AND STORAGE (continued)

B.- General conditions for storage

Avoid sources of heat, radiation, static electricity and contact with food. For additional information see subsection 10.5

7.3 Specific end use(s):

Except for the instructions already specified it is not necessary to provide any special recommendation regarding the uses of this product.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 Exposure control measures:

Substances whose occupational exposure limits have to be monitored in the workplace:

Workplace Exposure Standards for Airborne Contaminants 01/10/2022:

Identification	Occupational exposure limits		
Glutaraldehyde	TWA	0.1 ppm	0.41 mg/m³
CAS: 111-30-8	STEL		

8.2 Engineering controls:

A.- Individual protection measures, for example personal protective equipment (PPE)

As a preventative measure it is recommended to use basic Personal Protection Equipment. For more information on Personal Protection Equipment (storage, use, cleaning, maintenance, class of protection,…) consult the information leaflet provided by the manufacturer. For more information see subsection 7.1.
All information contained herein is a recommendation which needs some specification from the labour risk prevention services as it is not known whether the company has additional measures at its disposal.

B.- Respiratory protection

Pictogram	PPE	Remarks
 Mandatory respiratory tract protection	Filter mask for gases and vapours	Replace when there is a taste or smell of the contaminant inside the face mask. If the contaminant comes with warnings it is recommended to use isolation equipment.

C.- Specific protection for the hands

Pictogram	PPE	Remarks
 Mandatory hand protection	Chemical protective gloves (Material: Nitrile, Breakthrough time: > 480 min, Thickness: 0.4 mm)	Replace the gloves at any sign of deterioration.

As the product is a mixture of several substances, the resistance of the glove material can not be calculated in advance with total reliability and has therefore to be checked prior to the application.

D.- Eye and face protection

Pictogram	PPE	Remarks
 Mandatory face protection	Face shield	Clean daily and disinfect periodically according to the manufacturer´s instructions. Use if there is a risk of splashing.

E.- Bodily protection

Pictogram	PPE	Remarks
 Mandatory complete body protection	Disposable clothing for protection against chemical risks	For professional use only. Clean periodically according to the manufacturer´s instructions.

- CONTINUED ON NEXT PAGE -

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION (continued)

Pictogram	PPE	Remarks
 Mandatory foot protection	Safety footwear for protection against chemical risk	Replace boots at any sign of deterioration.

F.- Additional emergency measures

Emergency measure	Standards	Emergency measure	Standards
 Emergency shower	ANSI Z358-1 ISO 3864-1:2011, ISO 3864-4:2011	 Eyewash stations	DIN 12 899 ISO 3864-1:2011, ISO 3864-4:2011

Environmental exposure controls:

In accordance with the community legislation for the protection of the environment it is recommended to avoid environmental spillage of both the product and its container. For additional information see subsection 7.1.D

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties:

For complete information see the product datasheet.

Appearance:

Physical state at 20 ºC:	Liquid
Appearance:	Transparent
Color:	Colourless
Odor:	Fruity
Odour threshold:	Not available *

Volatility:

Boiling point at atmospheric pressure:	103 ºC
Vapour pressure at 20 ºC:	Not available *
Vapour pressure at 50 ºC:	Not available *
Evaporation rate at 20 ºC:	Not available *

Product description:

Density at 20 ºC:	1022.6 kg/m³
Relative density at 20 ºC:	1.023
Dynamic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 40 ºC:	Not available *
Concentration:	Not available *
pH:	4.1
Vapour density at 20 ºC:	Not available *
Partition coefficient n-octanol/water 20 ºC:	Not available *
Solubility in water at 20 ºC:	Not available *
Solubility properties:	Water-soluble
Decomposition temperature:	Not available *
Melting point/freezing point:	-15°C

Flammability:

Flash Point:	>100 ºC

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

Flammability (solid, gas):	Not available *
Autoignition temperature:	Not available *
Lower flammability limit:	Not available *
Upper flammability limit:	Not available *
Particle characteristics:	
Median equivalent diameter:	Non-applicable

9.2 Other information:

Information with regard to physical hazard classes:

Explosive properties:	Not available *
Oxidising properties:	Not available *
Corrosive to metals:	Not available *
Heat of combustion:	Not available *
Aerosols-total percentage (by mass) of flammable components:	Not available *
Other safety characteristics:	
Surface tension at 20 ºC:	Not available *
Refraction index:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity:

No hazardous reactions are expected because the product is stable under recommended storage conditions. See section 7 from Safety Data Sheet.

10.2 Chemical stability:

Chemically stable under the indicated conditions of storage, handling and use.

10.3 Possibility of hazardous reactions:

Under the specified conditions, hazardous reactions that lead to excessive temperatures or pressure are not expected.

10.4 Conditions to avoid:

Applicable for handling and storage at room temperature:

Shock and friction	Contact with air	Increase in temperature	Sunlight	Humidity
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

10.5 Incompatible materials:

Acids	Water	Oxidising materials	Combustible materials	Others
Avoid strong acids	Not applicable	Precaution	Not applicable	Avoid alkalis or strong bases

10.6 Hazardous decomposition products:

See subsection 10.3, 10.4 and 10.5 to find out the specific decomposition products. Depending on the decomposition conditions, complex mixtures of chemical substances can be released: carbon dioxide (CO_2), carbon monoxide and other organic compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects:

The experimental information related to the toxicological properties of the product itself is not available

Dangerous health implications:

In case of exposure that is repetitive, prolonged or at concentrations higher than recommended by the occupational exposure limits, it may result in adverse effects on health depending on the means of exposure:

A- Ingestion (acute effect):

- CONTINUED ON NEXT PAGE -

SECTION 11: TOXICOLOGICAL INFORMATION (continued)

- Acute toxicity: Based on available data, the classification criteria are not met, however, it contains substances classified as dangerous for consumption. For more information see section 3.
- Corrosivity/Irritability: Corrosive product, if it is swallowed causes burns destroying the tissues. For more information about secondary effects from skin contact see section 2.

B- Inhalation (acute effect):

- Acute toxicity : Based on available data, the classification criteria are not met. However, it contains substances classified as hazardous for inhalation. For more information see section 3.
- Corrosivity/Irritability: Prolonged inhalation of the product is corrosive to mucous membranes and the upper respiratory tract

C- Contact with the skin and the eyes (acute effect):

- Contact with the skin: Above all, skin contact may occur as fabrics of all thicknesses can be destroyed, resulting in burns. For more information on the secondary effects see section 2.
- Contact with the eyes: Produces serious eye damage after contact.

D- CMR effects (carcinogenicity, mutagenicity and toxicity to reproduction):

- Carcinogenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for the effects mentioned. For more information see section 3.
  IARC: Not available
- Mutagenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Reproductive toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

E- Sensitizing effects:

- Respiratory: Prolonged exposure can result in specific respiratory hypersensitivity.
- Skin: Prolonged contact with the skin can result in episodes of allergic contact dermatitis.

F- Specific target organ toxicity (STOT) - single exposure:

Causes irritation in respiratory passages, which is normally reversible and limited to the upper respiratory passages.

G- Specific target organ toxicity (STOT)-repeated exposure:

- Specific target organ toxicity (STOT)-repeated exposure: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

H- Aspiration hazard:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

Other information:

Not available

Specific toxicology information on the substances:

Identification	Acute toxicity		Genus
Benzalkonium chloride	LD50 oral	600 mg/kg (ATEi)	Rat
CAS: 8001-54-5	LD50 dermal	1560 mg/kg (ATEi)	Rat
	LC50 inhalation		
Glutaraldehyde	LD50 oral	246 mg/kg (ATEi)	Rat
CAS: 111-30-8	LD50 dermal		
	LC50 inhalation	3 mg/L (ATEi)	
Didecyldimethylammonium chloride	LD50 oral	410 mg/kg (ATEi)	Rat
CAS: 7173-51-5	LD50 dermal		
	LC50 inhalation		

SECTION 12: ECOLOGICAL INFORMATION

The experimental information related to the eco-toxicological properties of the product itself is not available

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

12.1 Ecotoxicity:

- CONTINUED ON NEXT PAGE -

SECTION 12: ECOLOGICAL INFORMATION (continued)

Acute toxicity:

Identification	Concentration		Species	Genus
Glutaraldehyde	LC50	13 mg/L (96 h)	Lepomis macrochirus	Fish
CAS: 111-30-8	EC50	14 mg/L (48 h)	Daphnia magna	Crustacean
	EC50	0.61 mg/L (72 h)	Scenedesmus subspicatus	Algae
Didecyldimethylammonium chloride	LC50	0.5 mg/L (96 h)	Brachydanio rerio	Fish
CAS: 7173-51-5	EC50	0.03 mg/L (48 h)	Daphnia magna	Crustacean
	EC50	0.06 mg/L (96 h)	Selenastrum capricornutum	Algae
Benzalkonium chloride	LC50	0.85 mg/L (96 h)	Oncorhynchus mykiss	Fish
CAS: 8001-54-5	EC50	0.12 mg/L (48 h)	Daphnia magna	Crustacean
	EC50	Not available		

Chronic toxicity:

Identification	Concentration		Species	Genus
Glutaraldehyde	NOEC	3.2 mg/L	Oncorhynchus mykiss	Fish
CAS: 111-30-8	NOEC	5 mg/L	Daphnia magna	Crustacean
Didecyldimethylammonium chloride	NOEC	Not available		
CAS: 7173-51-5	NOEC	0.021 mg/L	Daphnia magna	Crustacean

12.2 Persistence and degradability:

Substance-specific information:

Identification	Degradability		Biodegradability	
Glutaraldehyde	BOD5	Not available	Concentration	100 mg/L
CAS: 111-30-8	COD	Not available	Period	28 days
	BOD5/COD	Not available	% Biodegradable	59 %
Didecyldimethylammonium chloride	BOD5	Not available	Concentration	100 mg/L
CAS: 7173-51-5	COD	Not available	Period	28 days
	BOD5/COD	Not available	% Biodegradable	0 %

12.3 Bioaccumulative potential:

Substance-specific information:

Identification	Bioaccumulation potential	
Didecyldimethylammonium chloride	BCF	71
CAS: 7173-51-5	Pow Log	2.59
	Potential	Moderate

12.4 Mobility in soil:

Identification	Absorption/desorption		Volatility	
Glutaraldehyde	Koc	Not available	Henry	1.1E-2 Pa·m³/mol
CAS: 111-30-8	Conclusion	Not available	Dry soil	Yes
	Surface tension	Not available	Moist soil	Yes
Benzalkonium chloride	Koc	650000	Henry	Not available
CAS: 8001-54-5	Conclusion	Immobile	Dry soil	Not available
	Surface tension	Not available	Moist soil	Not available

12.5 Results of PBT and vPvB assessment:

Non-applicable

12.6 Other adverse effects:

Not described

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Disposal methods:

Waste management (disposal and evaluation):

- CONTINUED ON NEXT PAGE -

SECTION 13: DISPOSAL CONSIDERATIONS (continued)

Consult the authorized waste service manager on the assessment and disposal operations. In case the container has been in direct contact with the product, it will be processed the same way as the actual product. Otherwise, it will be processed as non-hazardous residue. Waste should not be disposed of to drains. See epigraph 6.2.

Regulations related to waste management:

Legislation related to waste management:

Basel Convention (Hazardous Waste)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 and Amendments

SECTION 14: TRANSPORT INFORMATION

Transport of dangerous goods by land:

With regard to ADG Code:

14.1	**UN number:**	UN1760
14.2	**Proper shipping name or Technical Name:**	CORROSIVE LIQUID, N.O.S. (Glutaraldehyde)
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	II
14.5	**Environmental hazards for Transport Purposes:**	Yes
14.6	**Special precautions for user**	
	Physico-Chemical properties:	see section 9
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

Transport of dangerous goods by sea:

With regard to IMDG 41-22:

14.1	**UN number:**	UN1760
14.2	**Proper shipping name or Technical Name:**	CORROSIVE LIQUID, N.O.S. (Glutaraldehyde)
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	II
14.5	**Marine pollutant:**	Yes
14.6	**Special precautions for user**	
	Special regulations:	274
	EmS Codes:	F-A, S-B
	Physico-Chemical properties:	see section 9
	Limited quantities:	1 L
	Segregation group:	Not available
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

Transport of dangerous goods by air:

With regard to IATA/ICAO 2024:

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SECTION 14: TRANSPORT INFORMATION (continued)

14.1	**UN number:**	UN1760
14.2	**Proper shipping name or Technical Name:**	CORROSIVE LIQUID, N.O.S. (Glutaraldehyde)
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	II
14.5	**Environmental hazards for Transport Purposes:**	Yes
14.6	**Special precautions for user**	
	Physico-Chemical properties:	see section 9
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations:

Specific provisions in terms of protecting people or the environment:

It is recommended to use the information included in this safety data sheet as data used in a risk evaluation of the local circumstances in order to establish the necessary risk prevention measures for the manipulation, use, storage and disposal of this product.

Industrial Chemicals Act 2019:

Industrial Chemicals (Notification and Assessment) Act 1989

SECTION 16: OTHER INFORMATION

Legislation related to safety data sheets:
This safety data sheet has been designed in accordance with WHS regulations and Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Texts of the legislative phrases mentioned in section 2:
H314: Causes severe skin burns and eye damage.
H318: Causes serious eye damage.
H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H317: May cause an allergic skin reaction.
H335: May cause respiratory irritation.

Texts of the legislative phrases mentioned in section 3:
The phrases indicated do not refer to the product itself; they are present merely for informative purposes and refer to the individual components which appear in section 3

WHS:
Acute Tox. 3: H301+H331 - Toxic if swallowed or if inhaled.
Acute Tox. 4: H302 - Harmful if swallowed.
Acute Tox. 4: H302+H312 - Harmful if swallowed or in contact with skin.
Eye Dam. 1: H318 - Causes serious eye damage.
Met. Corr. 1: H290 - May be corrosive to metals.
Resp. Sens. 1: H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled.
Skin Corr. 1B: H314 - Causes severe skin burns and eye damage.
Skin Sens. 1: H317 - May cause an allergic skin reaction.

Advice related to training:
Minimal training is recommended to prevent industrial risks for staff using this product, in order to facilitate their comprehension and interpretation of this safety data sheet, as well as the label on the product.

Principal bibliographical sources:
http://www.safeworkaustralia.gov.au/

Abbreviations and acronyms:

- CONTINUED ON NEXT PAGE -

SECTION 16: OTHER INFORMATION (continued)

ADG: Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG: International maritime dangerous goods code
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
COD: Chemical Oxygen Demand
BOD5: 5-day biochemical oxygen demand
BCF: Bioconcentration factor
LD50: Lethal Dose 50
CL50: Lethal Concentration 50
EC50: Effective concentration 50
Log-POW: Octanol-water partition coefficient
Koc: Partition coefficient of organic carbon
IARC: International Agency for Research on Cancer

END OF SAFETY DATA SHEET

SECTION 1: IDENTIFICATION

1.1 Product identifier: CSA-1F

Other means of identification:

Not available

1.2 Recommended use of the chemical and restrictions on use:

Relevant uses: Stabiliser . For professional users only.

Uses advised against: All uses not specified in this section or in section 7.3

1.3 Details of manufacturer or importer:

Fusion Technologies (Australia) Pty
Unit 3, 1472 Boundary Road
Wacol, Queensland 4076, Australia
Phone: +61 460 047 656
https://www.fusiontechinc.net/

Technical Inquries: help@fusiontechinc.net

1.4 Emergency phone number: **AU 1800 033 111 NZ 0800 734 607 (ALL HOURS)**

SECTION 2: HAZARD(S) IDENTIFICATION

2.1 Classification of the hazardous chemical:

WHS:

The product is not classified as dangerous according to Model Work Health and Safety Regulations(Hazardous Chemicals) Amendment 2020

2.2 Label elements, including precautionary statements:

WHS:

None

2.3 Other hazards which do not result in classification:

Not available

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

3.1 Substances:

Non-applicable

3.2 Mixtures:

Chemical description: Aqueous mixture composed of quaternary ammonia compounds

Components:

None of the substances contained in the mixture are above the values fixed in the Schedule 8 (WHS Regulations).

SECTION 4: FIRST AID MEASURES

4.1 Description of necessary first aid measures:

Consult a doctor in case of discomfort with this Safety data Sheet.

By inhalation:

In case of symptoms, move the person affected into fresh air.

By skin contact:

In case of contact it is recommended to clean the affected area thoroughly with water and neutral soap. In case of changes to the skin (stinging, redness, rashes, blisters,…), seek medical advice with this Safety Data Sheet

By eye contact:

Rinse with water until the product has been eliminated. In case of problems, consult a doctor with the SDS of this product.

By ingestion/aspiration:

In case of consumption in large quantities, it is recommended to seek medical assistance.

- CONTINUED ON NEXT PAGE -

SECTION 4: FIRST AID MEASURES (continued)

4.2 Symptoms caused by exposure:

Acute and delayed effects are indicated in sections 2 and 11.

4.3 Medical attention and special treatment:

Not available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable extinguishing equipment:

Suitable extinguishing media:

Product is non-flammable, low risk of fire by the inflammability characteristics of the product in normal conditions of storage, manipulation and use. In the case of the existence of sustained combustion as a result of improper manipulation, storage or use any type of extinguishing agent can be used (ABC Powder, water,...)

Unsuitable extinguishing media:

Non-applicable

5.2 Specific hazards arising from the chemical:

Due to its non-flammable nature, the product does not present a fire risk under normal conditions of storage, manipulation and use.

5.3 Special protective equipment and precautions for fire fighters:

Depending on the magnitude of the fire it may be necessary to use full protective clothing and individual respiratory equipment. Minimum emergency facilities and equipment should be available (fire blankets, portable first aid kit,...)

Additional provisions:

Act in accordance with the Internal Emergency Plan and the Information Sheets on actions to take after an accident or other emergencies. Destroy any source of ignition. In case of fire, refrigerate the storage containers and tanks for products susceptible to inflammation, explosion or BLEVE as a result of high temperatures. Avoid spillage of the products used to extinguish the fire into an aqueous medium.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures:

For non-emergency personnel:

Isolate leaks provided that there is no additional risk for the people performing this task.

For emergency responders:

Wear protective equipment. Keep unprotected persons away. See section 8.

6.2 Environmental precautions:

This product is not classified as hazardous to the environment. Keep product away from drains, surface and underground water.

6.3 Methods and materials for containment and cleaning up:

It is recommended:

Absorb the spillage using sand or inert absorbent and move it to a safe place. Do not absorb in sawdust or other combustible absorbents. For any concern related to disposal consult section 13.

6.4 Reference to other sections:

See sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling:

A.- General precautions for safe use

Comply with the current legislation concerning the prevention of industrial risks with regards manually handling weights. Maintain order, cleanliness and dispose of using safe methods (section 6).

B.- Technical recommendations for the prevention of fires and explosions

It is recommended to transfer at a slow speed to avoid the creation of electrostatic charges that could affect flammable products. Consult section 10 for conditions and materials that should be avoided.

- CONTINUED ON NEXT PAGE -

SECTION 7: HANDLING AND STORAGE (continued)

C.- Technical recommendations on general occupational hygiene

Do not eat or drink during the process, washing hands afterwards with suitable cleaning products.

D.- Technical recommendations to prevent environmental risks

It is not necessary to take special measures to prevent environmental risks. For more information see subsection 6.2

7.2 Conditions for safe storage, including any incompatibilities:

A.- Specific storage requirements

Minimum Temp.: 5 ºC

Maximum Temp.: 40 ºC

Maximum time: 6 Months

B.- General conditions for storage

Avoid sources of heat, radiation, static electricity and contact with food. For additional information see subsection 10.5

7.3 Specific end use(s):

Except for the instructions already specified it is not necessary to provide any special recommendation regarding the uses of this product.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 Exposure control measures:

Substances whose occupational exposure limits have to be monitored in the workplace:

There are no applicable occupational exposure limits for the substances contained in the product

8.2 Engineering controls:

A.- Individual protection measures, for example personal protective equipment (PPE)

As a preventative measure it is recommended to use basic Personal Protection Equipment. For more information on Personal Protection Equipment (storage, use, cleaning, maintenance, class of protection,…) consult the information leaflet provided by the manufacturer. For more information see subsection 7.1.
All information contained herein is a recommendation which needs some specification from the labour risk prevention services as it is not known whether the company has additional measures at its disposal.

B.- Respiratory protection

The use of protection equipment will be necessary if a mist forms or if the occupational exposure limits are exceeded.

C.- Specific protection for the hands

Pictogram	PPE	Remarks
 Mandatory hand protection	Protective gloves against minor risks	Replace gloves in case of any sign of damage. For prolonged periods of exposure to the product for professional users/industrials, we recommend using chemical protection gloves

As the product is a mixture of several substances, the resistance of the glove material can not be calculated in advance with total reliability and has therefore to be checked prior to the application.

D.- Eye and face protection

Pictogram	PPE	Remarks
 Mandatory face protection	Panoramic glasses against splash/projections.	Clean daily and disinfect periodically according to the manufacturer´s instructions. Use if there is a risk of splashing.

E.- Bodily protection

Pictogram	PPE	Remarks
	Work clothing	Replace before any evidence of deterioration.

- CONTINUED ON NEXT PAGE -

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION (continued)

Pictogram	PPE	Remarks
	Anti-slip work shoes	Replace before any evidence of deterioration.

F.- Additional emergency measures

It is not necessary to take additional emergency measures.

Environmental exposure controls:

In accordance with the community legislation for the protection of the environment it is recommended to avoid environmental spillage of both the product and its container. For additional information see subsection 7.1.D

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties:

For complete information see the product datasheet.

Appearance:

Physical state at 20 ºC:	Liquid
Appearance:	Transparent
Color:	Light yellow
Odor:	Aminic
Odour threshold:	Not available *

Volatility:

Boiling point at atmospheric pressure:	100 ºC
Vapour pressure at 20 ºC:	>2350 Pa
Vapour pressure at 50 ºC:	12381.01 Pa (12.38 kPa)
Evaporation rate at 20 ºC:	Not available *

Product description:

Density at 20 ºC:	Not available *
Relative density at 20 ºC:	1.045 - 1.085
Dynamic viscosity at 20 ºC:	2.82 cP
Kinematic viscosity at 20 ºC:	2.46 mm²/s
Kinematic viscosity at 40 ºC:	Not available *
Concentration:	Not available *
pH:	6.5 - 7.9
Vapour density at 20 ºC:	Not available *
Partition coefficient n-octanol/water 20 ºC:	Not available *
Solubility in water at 20 ºC:	Not available *
Solubility properties:	Water-soluble
Decomposition temperature:	Not available *
Melting point/freezing point:	-18 ºC

Flammability:

Flash Point:	Non Flammable (>93 ºC)
Flammability (solid, gas):	Not available *
Autoignition temperature:	Not available *
Lower flammability limit:	Not available *
Upper flammability limit:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

Particle characteristics:

Median equivalent diameter:	Non-applicable

9.2 Other information:

Information with regard to physical hazard classes:

Explosive properties:	Not available *
Oxidising properties:	Not available *
Corrosive to metals:	Not available *
Heat of combustion:	Not available *
Aerosols-total percentage (by mass) of flammable components:	Not available *

Other safety characteristics:

Surface tension at 20 ºC:	Not available *
Refraction index:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity:

No hazardous reactions are expected because the product is stable under recommended storage conditions. See section 7 from Safety Data Sheet.

10.2 Chemical stability:

Chemically stable under the indicated conditions of storage, handling and use.

10.3 Possibility of hazardous reactions:

Under the specified conditions, hazardous reactions that lead to excessive temperatures or pressure are not expected.

10.4 Conditions to avoid:

Applicable for handling and storage at room temperature:

Shock and friction	Contact with air	Increase in temperature	Sunlight	Humidity
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

10.5 Incompatible materials:

Acids	Water	Oxidising materials	Combustible materials	Others
Avoid strong acids	Not applicable	Not applicable	Not applicable	Avoid alkalis or strong bases

10.6 Hazardous decomposition products:

See subsection 10.3, 10.4 and 10.5 to find out the specific decomposition products. Depending on the decomposition conditions, complex mixtures of chemical substances can be released: carbon dioxide (CO_2), carbon monoxide and other organic compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects:

LD50 oral > 5000 mg/kg (rat)

Dangerous health implications:

In case of exposure that is repetitive, prolonged or at concentrations higher than recommended by the occupational exposure limits, it may result in adverse effects on health depending on the means of exposure:

A- Ingestion (acute effect):

- Acute toxicity: Based on available data, the classification criteria are not met
- Corrosivity/Irritability: Based on available data, the classification criteria are not met

B- Inhalation (acute effect):

- Acute toxicity : Based on available data, the classification criteria are not met
- Corrosivity/Irritability: Based on available data, the classification criteria are not met

- CONTINUED ON NEXT PAGE -

SECTION 11: TOXICOLOGICAL INFORMATION (continued)

C- Contact with the skin and the eyes (acute effect):

- Contact with the skin: Based on available data, the classification criteria are not met
- Contact with the eyes: Based on available data, the classification criteria are not met

D- CMR effects (carcinogenicity, mutagenicity and toxicity to reproduction):

- Carcinogenicity: Based on available data, the classification criteria are not met
  IARC: Not available
- Mutagenicity: Based on available data, the classification criteria are not met
- Reproductive toxicity: Based on available data, the classification criteria are not met

E- Sensitizing effects:

- Respiratory: Based on available data, the classification criteria are not met
- Skin: Based on available data, the classification criteria are not met

F- Specific target organ toxicity (STOT) - single exposure:

Based on available data, the classification criteria are not met

G- Specific target organ toxicity (STOT)-repeated exposure:

- Specific target organ toxicity (STOT)-repeated exposure: Based on available data, the classification criteria are not met
- Skin: Based on available data, the classification criteria are not met

H- Aspiration hazard:

Based on available data, the classification criteria are not met

Other information:

Not available

Specific toxicology information on the substances:

Not available

SECTION 12: ECOLOGICAL INFORMATION

The experimental information related to the eco-toxicological properties of the product itself is not available

Based on available data, the classification criteria are not met

12.1 Ecotoxicity:

Not available

12.2 Persistence and degradability:

Not available

12.3 Bioaccumulative potential:

Not available

12.4 Mobility in soil:

Not available

12.5 Results of PBT and vPvB assessment:

Non-applicable

12.6 Other adverse effects:

Not described

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Disposal methods:

Waste management (disposal and evaluation):

Consult the authorized waste service manager on the assessment and disposal operations. In case the container has been in direct contact with the product, it will be processed the same way as the actual product. Otherwise, it will be processed as non-hazardous residue. Waste should not be disposed of to drains. See epigraph 6.2.

Regulations related to waste management:

- CONTINUED ON NEXT PAGE -

SECTION 13: DISPOSAL CONSIDERATIONS (continued)

Legislation related to waste management:

Basel Convention (Hazardous Waste)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 and Amendments

SECTION 14: TRANSPORT INFORMATION

This product is not regulated for transport.

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations:

Specific provisions in terms of protecting people or the environment:

It is recommended to use the information included in this safety data sheet as data used in a risk evaluation of the local circumstances in order to establish the necessary risk prevention measures for the manipulation, use, storage and disposal of this product.

Industrial Chemicals Act 2019:

Industrial Chemicals (Notification and Assessment) Act 1989

SECTION 16: OTHER INFORMATION

Legislation related to safety data sheets:
This safety data sheet has been designed in accordance with WHS regulations and Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Texts of the legislative phrases mentioned in section 3:
The phrases indicated do not refer to the product itself; they are present merely for informative purposes and refer to the individual components which appear in section 3

WHS:
Not available

Advice related to training:
Minimal training is recommended to prevent industrial risks for staff using this product, in order to facilitate their comprehension and interpretation of this safety data sheet, as well as the label on the product.

Principal bibliographical sources:
http://www.safeworkaustralia.gov.au/

Abbreviations and acronyms:
ADG: Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG: International maritime dangerous goods code
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
COD: Chemical Oxygen Demand
BOD5: 5-day biochemical oxygen demand
BCF: Bioconcentration factor
LD50: Lethal Dose 50
CL50: Lethal Concentration 50
EC50: Effective concentration 50
Log-POW: Octanol-water partition coefficient
Koc: Partition coefficient of organic carbon
IARC: International Agency for Research on Cancer

END OF SAFETY DATA SHEET

SECTION 1: IDENTIFICATION

1.1 Product identifier: FLUSH FLUID

Distillates (petroleum), hydrotreated

CAS: 64742-47-8

Other means of identification:

Not available

1.2 Recommended use of the chemical and restrictions on use:

Relevant uses: Oils. For professional users only.

Uses advised against: All uses not specified in this section or in section 7.3

1.3 Details of manufacturer or importer:

Fusion Technologies (Australia) Pty
Unit 3, 1472 Boundary Road
Wacol, Queensland 4076, Australia
Phone: +61 460 047 656
https://www.fusiontechinc.net/

Technical Inquries: help@fusiontechinc.net

1.4 Emergency phone number: **AU 1800 033 111 NZ 0800 734 607 (ALL HOURS)**

SECTION 2: HAZARD(S) IDENTIFICATION

2.1 Classification of the hazardous chemical:

WHS:

Classification of this product has been carried out in accordance with Model Work Health and Safety Regulations(Hazardous Chemicals) Amendment 2022

Asp. Tox. 1: Aspiration hazard, Category 1, H304
Flam. Liq. 4: Flammable liquids, Category 4, H227

2.2 Label elements, including precautionary statements:

WHS:

Danger

Hazard statements:

Asp. Tox. 1: H304 - May be fatal if swallowed and enters airways.
Flam. Liq. 4: H227 - Combustible liquid.

Precautionary statements:

P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P280: Wear protective gloves/protective clothing/eye protection/protective footwear.
P301+P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P331: Do NOT induce vomiting.
P370+P378: In case of fire: Use Foam extinguisher (AB), Dry Chemical Powder (ABC) Fire Extinguisher, Carbon dioxide extinguisher (BC) to extinguish.
P403: Store in a well-ventilated place.
P405: Store locked up.
P501: Dispose of contents and / or containers in accordance with regulations on hazardous waste or packaging and packaging waste respectively.

2.3 Other hazards which do not result in classification:

Not available

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

3.1 Substances:

Chemical description: Petrol distillates

In accordance with Schedule 8 (WHS Regulations), the product contains:

- CONTINUED ON NEXT PAGE -

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8 (continued)

Identification	Chemical name/Classification	Concentration
CAS: 64742-47-8	**Distillates (petroleum), hydrotreated** Asp. Tox. 1: H304; Flam. Liq. 4: H227 - Danger	**100 %**

To obtain more information on the hazards of the substances consult sections 11, 12 and 16.

3.2 Mixtures:

Non-applicable

SECTION 4: FIRST AID MEASURES

4.1 Description of necessary first aid measures:

The symptoms resulting from intoxication can appear after exposure, therefore, in case of doubt, seek medical attention for direct exposure to the chemical product or persistent discomfort, showing the SDS of this product.

By inhalation:

This product does not contain substances classified as hazardous for inhalation, however, in case of symptoms of intoxication remove the person affected from the exposure area and provide with fresh air. Seek medical attention if the symptoms get worse or persist.

By skin contact:

In case of contact it is recommended to clean the affected area thoroughly with water and neutral soap. In case of changes to the skin (stinging, redness, rashes, blisters,…), seek medical advice with this Safety Data Sheet

By eye contact:

This product does not contain substances classified as hazardous for eye contact. Rinse eyes thoroughly for at least 15 minutes with lukewarm water, ensuring that the person affected does not rub or close their eyes.

By ingestion/aspiration:

Request medical assistance immediately, showing the SDS of this product. Do not induce vomiting, but if it does happen keep the head down to avoid aspiration. In the case of loss of consciousness do not administrate anything orally unless supervised by a doctor. Rinse out the mouth and throat, as they may have been affected during ingestion. Keep the person affected at rest.

4.2 Symptoms caused by exposure:

Acute and delayed effects are indicated in sections 2 and 11.

4.3 Medical attention and special treatment:

Not available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable extinguishing equipment:

Suitable extinguishing media:

Foam extinguisher (AB), Dry Chemical Powder (ABC) Fire Extinguisher, Carbon dioxide extinguisher (BC)

Unsuitable extinguishing media:

Water jet

5.2 Specific hazards arising from the chemical:

As a result of combustion or thermal decomposition reactive sub-products are created that can become highly toxic and, consequently, can present a serious health risk.

5.3 Special protective equipment and precautions for fire fighters:

Depending on the magnitude of the fire it may be necessary to use full protective clothing and individual respiratory equipment. Minimum emergency facilities and equipment should be available (fire blankets, portable first aid kit,...)

Additional provisions:

Act in accordance with the Internal Emergency Plan and the Information Sheets on actions to take after an accident or other emergencies. Destroy any source of ignition. In case of fire, refrigerate the storage containers and tanks for products susceptible to inflammation, explosion or BLEVE as a result of high temperatures. Avoid spillage of the products used to extinguish the fire into an aqueous medium.

- CONTINUED ON NEXT PAGE -

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures:

For non-emergency personnel:

Isolate leaks provided that there is no additional risk for the people performing this task. Personal protection equipment must be used against potential contact with the spilt product (See section 8). Evacuate the area and keep out those who do not have protection.

For emergency responders:

Wear protective equipment. Keep unprotected persons away. See section 8.

6.2 Environmental precautions:

This product is not classified as hazardous to the environment. Keep product away from drains, surface and underground water.

6.3 Methods and materials for containment and cleaning up:

It is recommended:

Absorb the spillage using sand or inert absorbent and move it to a safe place. Do not absorb in sawdust or other combustible absorbents. For any concern related to disposal consult section 13.

6.4 Reference to other sections:

See sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling:

A.- General precautions for safe use

Comply with the current legislation concerning the prevention of industrial risks with regards manually handling weights. Maintain order, cleanliness and dispose of using safe methods (section 6).

B.- Technical recommendations for the prevention of fires and explosions

Product is non-flammable under normal conditions of storage, manipulation and use. It is recommended to transfer at slow speeds to avoid the generation of electrostatic charges that can affect flammable products. Consult section 10 for information on conditions and materials that should be avoided.

C.- Technical recommendations on general occupational hygiene

Do not eat or drink during the process, washing hands afterwards with suitable cleaning products.

D.- Technical recommendations to prevent environmental risks

It is recommended to have absorbent material available at close proximity to the product (See subsection 6.3)

7.2 Conditions for safe storage, including any incompatibilities:

A.- Specific storage requirements

Minimum Temp.:	5 ºC
Maximum Temp.:	40 ºC
Maximum time:	6 Months

B.- General conditions for storage

Avoid sources of heat, radiation, static electricity and contact with food. For additional information see subsection 10.5

7.3 Specific end use(s):

Except for the instructions already specified it is not necessary to provide any special recommendation regarding the uses of this product.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 Exposure control measures:

Substances whose occupational exposure limits have to be monitored in the workplace:

There are no applicable occupational exposure limits for the substances contained in the product

8.2 Engineering controls:

A.- Individual protection measures, for example personal protective equipment (PPE)

- CONTINUED ON NEXT PAGE -

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION (continued)

As a preventative measure it is recommended to use basic Personal Protection Equipment. For more information on Personal Protection Equipment (storage, use, cleaning, maintenance, class of protection,…) consult the information leaflet provided by the manufacturer. For more information see subsection 7.1.
All information contained herein is a recommendation which needs some specification from the labour risk prevention services as it is not known whether the company has additional measures at its disposal.

B.- Respiratory protection

The use of protection equipment will be necessary if a mist forms or if the occupational exposure limits are exceeded.

C.- Specific protection for the hands

Pictogram	PPE	Remarks
 Mandatory hand protection	Chemical protective gloves (Material: Nitrile, Thickness: 0.3 mm)	Replace the gloves at any sign of deterioration.

D.- Eye and face protection

Pictogram	PPE	Remarks
 Mandatory face protection	Panoramic glasses against splash/projections.	Clean daily and disinfect periodically according to the manufacturer´s instructions. Use if there is a risk of splashing.

E.- Bodily protection

Pictogram	PPE	Remarks
	Work clothing	Replace before any evidence of deterioration.
	Anti-slip work shoes	Replace before any evidence of deterioration.

F.- Additional emergency measures

Emergency measure	Standards	Emergency measure	Standards
 Emergency shower	ANSI Z358-1 ISO 3864-1:2011, ISO 3864-4:2011	 Eyewash stations	DIN 12 899 ISO 3864-1:2011, ISO 3864-4:2011

Environmental exposure controls:

In accordance with the community legislation for the protection of the environment it is recommended to avoid environmental spillage of both the product and its container. For additional information see subsection 7.1.D

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties:

For complete information see the product datasheet.

Appearance:

Physical state at 20 ºC:	Liquid
Appearance:	Transparent
Color:	Colourless
Odor:	Hydrocarbon
Odour threshold:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

Volatility:	
Boiling point at atmospheric pressure:	200 ºC
Vapour pressure at 20 ºC:	2 Pa
Vapour pressure at 50 ºC:	33.42 Pa (0.03 kPa)
Evaporation rate at 20 ºC:	Not available *
Product description:	
Density at 20 ºC:	795.5 kg/m³
Relative density at 20 ºC:	0.805 - 0.825
Dynamic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 40 ºC:	Not available *
Concentration:	Not available *
pH:	Not available *
Vapour density at 20 ºC:	Not available *
Partition coefficient n-octanol/water 20 ºC:	Not available *
Solubility in water at 20 ºC:	Not available *
Solubility properties:	Insoluble in water
Decomposition temperature:	Not available *
Melting point/freezing point:	-27 ºC
Flammability:	
Flash Point:	115 ºC
Flammability (solid, gas):	Not available *
Autoignition temperature:	225 ºC
Lower flammability limit:	0.7 % Volume
Upper flammability limit:	5.3 % Volume
Particle characteristics:	
Median equivalent diameter:	Non-applicable

9.2 Other information:

Information with regard to physical hazard classes:	
Explosive properties:	Not available *
Oxidising properties:	Not available *
Corrosive to metals:	Not available *
Heat of combustion:	Not available *
Aerosols-total percentage (by mass) of flammable components:	Not available *
Other safety characteristics:	
Surface tension at 20 ºC:	Not available *
Refraction index:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity:

No hazardous reactions are expected because the product is stable under recommended storage conditions. See section 7 from Safety Data Sheet.

10.2 Chemical stability:

Chemically stable under the indicated conditions of storage, handling and use.

- CONTINUED ON NEXT PAGE -

SECTION 10: STABILITY AND REACTIVITY (continued)

10.3 Possibility of hazardous reactions:

Under the specified conditions, hazardous reactions that lead to excessive temperatures or pressure are not expected.

10.4 Conditions to avoid:

Applicable for handling and storage at room temperature:

Shock and friction	Contact with air	Increase in temperature	Sunlight	Humidity
Not applicable	Not applicable	Risk of combustion	Avoid direct impact	Not applicable

10.5 Incompatible materials:

Acids	Water	Oxidising materials	Combustible materials	Others
Avoid strong acids	Not applicable	Not applicable	Not applicable	Avoid alkalis or strong bases

10.6 Hazardous decomposition products:

See subsection 10.3, 10.4 and 10.5 to find out the specific decomposition products. Depending on the decomposition conditions, complex mixtures of chemical substances can be released: carbon dioxide (CO_2), carbon monoxide and other organic compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects:

The experimental information related to the toxicological properties of the product itself is not available

Dangerous health implications:

In case of exposure that is repetitive, prolonged or at concentrations higher than recommended by the occupational exposure limits, it may result in adverse effects on health depending on the means of exposure:

A- Ingestion (acute effect):

- Acute toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for consumption. For more information see section 3
- Corrosivity/Irritability: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

B- Inhalation (acute effect):

- Acute toxicity : Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for inhalation. For more information see section 3.
- Corrosivity/Irritability: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

C- Contact with the skin and the eyes (acute effect):

- Contact with the skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for skin contact. For more information see section 3.
- Contact with the eyes: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

D- CMR effects (carcinogenicity, mutagenicity and toxicity to reproduction):

- Carcinogenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for the effects mentioned. For more information see section 3.
  IARC: Distillates (petroleum), hydrotreated (3)
- Mutagenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Reproductive toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

E- Sensitizing effects:

- Respiratory: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous with sensitising effects. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

F- Specific target organ toxicity (STOT) - single exposure:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

G- Specific target organ toxicity (STOT)-repeated exposure:

- CONTINUED ON NEXT PAGE -

SECTION 11: TOXICOLOGICAL INFORMATION (continued)

- Specific target organ toxicity (STOT)-repeated exposure: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

H- Aspiration hazard:

May be fatal if swallowed and enters airways.

Other information:

Not available

Specific toxicology information on the substances:

Not available

SECTION 12: ECOLOGICAL INFORMATION

The experimental information related to the eco-toxicological properties of the product itself is not available

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

12.1 Ecotoxicity:

Not available

12.2 Persistence and degradability:

Not available

12.3 Bioaccumulative potential:

Not available

12.4 Mobility in soil:

Not available

12.5 Results of PBT and vPvB assessment:

Non-applicable

12.6 Other adverse effects:

Not described

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Disposal methods:

Waste management (disposal and evaluation):

Consult the authorized waste service manager on the assessment and disposal operations. In case the container has been in direct contact with the product, it will be processed the same way as the actual product. Otherwise, it will be processed as non-hazardous residue. Waste should not be disposed of to drains. See epigraph 6.2.

Regulations related to waste management:

Legislation related to waste management:

Basel Convention (Hazardous Waste)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 and Amendments

SECTION 14: TRANSPORT INFORMATION

This product is not regulated for transport.

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations:

- CONTINUED ON NEXT PAGE -

SECTION 15: REGULATORY INFORMATION (continued)

Specific provisions in terms of protecting people or the environment:

It is recommended to use the information included in this safety data sheet as data used in a risk evaluation of the local circumstances in order to establish the necessary risk prevention measures for the manipulation, use, storage and disposal of this product.

Industrial Chemicals Act 2019:

Industrial Chemicals (Notification and Assessment) Act 1989

SECTION 16: OTHER INFORMATION

Legislation related to safety data sheets:

This safety data sheet has been designed in accordance with WHS regulations and Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Texts of the legislative phrases mentioned in section 2:

H304: May be fatal if swallowed and enters airways.
H227: Combustible liquid.

Texts of the legislative phrases mentioned in section 3:

The phrases indicated do not refer to the product itself; they are present merely for informative purposes and refer to the individual components which appear in section 3

WHS:

Asp. Tox. 1: H304 - May be fatal if swallowed and enters airways.
Flam. Liq. 4: H227 - Combustible liquid.

Advice related to training:

Minimal training is recommended to prevent industrial risks for staff using this product, in order to facilitate their comprehension and interpretation of this safety data sheet, as well as the label on the product.

Principal bibliographical sources:

http://www.safeworkaustralia.gov.au/

Abbreviations and acronyms:

ADG: Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG: International maritime dangerous goods code
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
COD: Chemical Oxygen Demand
BOD5: 5-day biochemical oxygen demand
BCF: Bioconcentration factor
LD50: Lethal Dose 50
CL50: Lethal Concentration 50
EC50: Effective concentration 50
Log-POW: Octanol-water partition coefficient
Koc: Partition coefficient of organic carbon
IARC: International Agency for Research on Cancer

END OF SAFETY DATA SHEET

SECTION 1: IDENTIFICATION

1.1 Product identifier: FRP-BL1F

Other means of identification:

Not available

1.2 Recommended use of the chemical and restrictions on use:

Relevant uses: Anti-friction treatment. For professional users only.

Uses advised against: All uses not specified in this section or in section 7.3

1.3 Details of manufacturer or importer:

Fusion Technologies (Australia) Pty
Unit 3, 1472 Boundary Road
Wacol, Queensland 4076, Australia
Phone: +61 460 047 656
https://www.fusiontechinc.net/

Technical Inquries: help@fusiontechinc.net

1.4 Emergency phone number: **AU 1800 033 111 NZ 0800 734 607 (ALL HOURS)**

SECTION 2: HAZARD(S) IDENTIFICATION

2.1 Classification of the hazardous chemical:

WHS:

Classification of this product has been carried out in accordance with Model Work Health and Safety Regulations(Hazardous Chemicals) Amendment 2022

Not Classified.

2.2 Label elements, including precautionary statements:

WHS:

Hazard pictogram(s): None

Hazard statements: None

Precautionary statements: None

2.3 Other hazards which do not result in classification:

Not available

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

3.1 Substances:

Non-applicable

3.2 Mixtures:

Chemical description: Polymer/s

- CONTINUED ON NEXT PAGE -

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8 (continued)

Components:

In accordance with Schedule 8 (WHS Regulations), the product contains:

Identification	Chemical name/Classification	Concentration
CAS: 64742-47-8	**Distillates (petroleum), hydrotreated light** Asp. Tox. 1: H304	**20 - 45 %**
CAS: 69011-36-5	**Isotridecanol, ethoxylated** Acute Tox. 4: H302; Eye Dam. 1: H318	**<5 %**

To obtain more information on the hazards of the substances consult sections 11, 12 and 16.

SECTION 4: FIRST AID MEASURES

4.1 Description of necessary first aid measures:

The symptoms resulting from intoxication can appear after exposure, therefore, in case of doubt, seek medical attention for direct exposure to the chemical product or persistent discomfort, showing the SDS of this product.

By inhalation:

This product does not contain substances classified as hazardous for inhalation, however, in case of symptoms of intoxication remove the person affected from the exposure area and provide with fresh air. Seek medical attention if the symptoms get worse or persist.

By skin contact:

Remove contaminated clothing and footwear, rinse skin or shower the person affected if appropriate with plenty of cold water and neutral soap. In serious cases see a doctor. If the product causes burns or freezing, clothing should not be removed as this could worsen the injury caused if it is stuck to the skin. If blisters form on the skin, these should never be burst as this will increase the risk of infection.

By eye contact:

Rinse eyes thoroughly with lukewarm water for at least 15 minutes. Do not allow the person affected to rub or close their eyes. If the injured person uses contact lenses, these should be removed unless they are stuck to the eyes, as this could cause further damage. In all cases, after cleaning, a doctor should be consulted as quickly as possible with the SDS of the product.

By ingestion/aspiration:

Do not induce vomiting, but if it does happen keep the head down to avoid aspiration. Keep the person affected at rest. Rinse out the mouth and throat, as they may have been affected during ingestion.

4.2 Symptoms caused by exposure:

Acute and delayed effects are indicated in sections 2 and 11.

4.3 Medical attention and special treatment:

Not available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable extinguishing equipment:

Suitable extinguishing media:

Product is non-flammable under normal conditions of storage, manipulation and use, but the product contains flammable substances. In the case of inflammation as a result of improper manipulation, storage or use preferably use polyvalent powder extinguishers (ABC powder), in accordance with the Regulation on fire protection systems.

Unsuitable extinguishing media:

IT IS RECOMMENDED NOT to use full jet water as an extinguishing agent.

5.2 Specific hazards arising from the chemical:

As a result of combustion or thermal decomposition reactive sub-products are created that can become highly toxic and, consequently, can present a serious health risk.

5.3 Special protective equipment and precautions for fire fighters:

Depending on the magnitude of the fire it may be necessary to use full protective clothing and individual respiratory equipment. Minimum emergency facilities and equipment should be available (fire blankets, portable first aid kit,...)

- CONTINUED ON NEXT PAGE -

SECTION 5: FIREFIGHTING MEASURES (continued)

Additional provisions:

Act in accordance with the Internal Emergency Plan and the Information Sheets on actions to take after an accident or other emergencies. Destroy any source of ignition. In case of fire, refrigerate the storage containers and tanks for products susceptible to inflammation, explosion or BLEVE as a result of high temperatures. Avoid spillage of the products used to extinguish the fire into an aqueous medium.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures:

For non-emergency personnel:

Isolate leaks provided that there is no additional risk for the people performing this task. Personal protection equipment must be used against potential contact with the spilt product (See section 8). Evacuate the area and keep out those who do not have protection.

For emergency responders:

Wear protective equipment. Keep unprotected persons away. See section 8.

6.2 Environmental precautions:

This product is not classified as hazardous to the environment. Keep product away from drains, surface and underground water.

6.3 Methods and materials for containment and cleaning up:

It is recommended:

Absorb the spillage using sand or inert absorbent and move it to a safe place. Do not absorb in sawdust or other combustible absorbents. For any concern related to disposal consult section 13.

6.4 Reference to other sections:

See sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling:

A.- General precautions for safe use

Comply with the current legislation concerning the prevention of industrial risks with regards manually handling weights. Maintain order, cleanliness and dispose of using safe methods (section 6).

B.- Technical recommendations for the prevention of fires and explosions

Product is non-flammable under normal conditions of storage, manipulation and use. It is recommended to transfer at slow speeds to avoid the generation of electrostatic charges that can affect flammable products. Consult section 10 for information on conditions and materials that should be avoided.

C.- Technical recommendations on general occupational hygiene

Do not eat or drink during the process, washing hands afterwards with suitable cleaning products.

D.- Technical recommendations to prevent environmental risks

It is recommended to have absorbent material available at close proximity to the product (See subsection 6.3)

7.2 Conditions for safe storage, including any incompatibilities:

A.- Specific storage requirements

Minimum Temp.:	5 ºC
Maximum Temp.:	40 ºC
Maximum time:	6 Months

B.- General conditions for storage

Avoid sources of heat, radiation, static electricity and contact with food. For additional information see subsection 10.5

7.3 Specific end use(s):

Except for the instructions already specified it is not necessary to provide any special recommendation regarding the uses of this product.

- CONTINUED ON NEXT PAGE -

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 Exposure control measures:

Substances whose occupational exposure limits have to be monitored in the workplace:

There are no applicable occupational exposure limits for the substances contained in the product

8.2 Engineering controls:

A.- Individual protection measures, for example personal protective equipment (PPE)

As a preventative measure it is recommended to use basic Personal Protection Equipment. For more information on Personal Protection Equipment (storage, use, cleaning, maintenance, class of protection,…) consult the information leaflet provided by the manufacturer. For more information see subsection 7.1.
All information contained herein is a recommendation which needs some specification from the labour risk prevention services as it is not known whether the company has additional measures at its disposal.

B.- Respiratory protection

The use of protection equipment will be necessary if a mist forms or if the occupational exposure limits are exceeded.

C.- Specific protection for the hands

Pictogram	PPE	Remarks
 Mandatory hand protection	Protective gloves against minor risks	Replace gloves in case of any sign of damage. For prolonged periods of exposure to the product for professional users/industrials, we recommend using chemical protection gloves

As the product is a mixture of several substances, the resistance of the glove material can not be calculated in advance with total reliability and has therefore to be checked prior to the application.

D.- Eye and face protection

Pictogram	PPE	Remarks
 Mandatory face protection	Panoramic glasses against splash/projections.	Clean daily and disinfect periodically according to the manufacturer´s instructions. Use if there is a risk of splashing.

E.- Bodily protection

Pictogram	PPE	Remarks
	Work clothing	Replace before any evidence of deterioration.
	Anti-slip work shoes	Replace before any evidence of deterioration.

F.- Additional emergency measures

Emergency measure	Standards	Emergency measure	Standards
 Emergency shower	ANSI Z358-1 ISO 3864-1:2011, ISO 3864-4:2011	 Eyewash stations	DIN 12 899 ISO 3864-1:2011, ISO 3864-4:2011

Environmental exposure controls:

In accordance with the community legislation for the protection of the environment it is recommended to avoid environmental spillage of both the product and its container. For additional information see subsection 7.1.D

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties:

For complete information see the product datasheet.

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

Appearance:

Physical state at 20 ºC:	Liquid
Appearance:	Viscous
Color:	White
Odor:	Hydrocarbon
Odour threshold:	Not available *

Volatility:

Boiling point at atmospheric pressure:	>100 ºC
Vapour pressure at 20 ºC:	2193 Pa
Vapour pressure at 50 ºC:	11557.39 Pa (11.56 kPa)
Evaporation rate at 20 ºC:	Not available *

Product description:

Density at 20 ºC:	Not available *
Relative density at 20 ºC:	1 - 1.2
Dynamic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 40 ºC:	>20.5 mm^2/s
Concentration:	Not available *
pH:	5 - 9
Vapour density at 20 ºC:	Not available *
Partition coefficient n-octanol/water 20 ºC:	Not available *
Solubility in water at 20 ºC:	Not available *
Solubility properties:	Partially water-soluble
Decomposition temperature:	Not available *
Melting point/freezing point:	<5 ºC

Flammability:

Flash Point:	Non Flammable (>93 ºC)
Flammability (solid, gas):	Not available *
Autoignition temperature:	225 ºC
Lower flammability limit:	Not available *
Upper flammability limit:	Not available *

Particle characteristics:

Median equivalent diameter:	Non-applicable

9.2 Other information:

Information with regard to physical hazard classes:

Explosive properties:	Not available *
Oxidising properties:	Not available *
Corrosive to metals:	Not available *
Heat of combustion:	Not available *
Aerosols-total percentage (by mass) of flammable components:	Not available *

Other safety characteristics:

Surface tension at 20 ºC:	Not available *
Refraction index:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

- CONTINUED ON NEXT PAGE -

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity:

No hazardous reactions are expected because the product is stable under recommended storage conditions. See section 7 from Safety Data Sheet.

10.2 Chemical stability:

Chemically stable under the indicated conditions of storage, handling and use.

10.3 Possibility of hazardous reactions:

Under the specified conditions, hazardous reactions that lead to excessive temperatures or pressure are not expected.

10.4 Conditions to avoid:

Applicable for handling and storage at room temperature:

Shock and friction	Contact with air	Increase in temperature	Sunlight	Humidity
Not applicable	Not applicable	Precaution	Precaution	Not applicable

10.5 Incompatible materials:

Acids	Water	Oxidising materials	Combustible materials	Others
Avoid strong acids	Not applicable	Not applicable	Not applicable	Avoid alkalis or strong bases

10.6 Hazardous decomposition products:

See subsection 10.3, 10.4 and 10.5 to find out the specific decomposition products. Depending on the decomposition conditions, complex mixtures of chemical substances can be released: carbon dioxide (CO_2), carbon monoxide and other organic compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects:

The experimental information related to the toxicological properties of the product itself is not available

Dangerous health implications:

In case of exposure that is repetitive, prolonged or at concentrations higher than recommended by the occupational exposure limits, it may result in adverse effects on health depending on the means of exposure:

A- Ingestion (acute effect):

- Acute toxicity: Based on available data, the classification criteria are not met, however, it contains substances classified as dangerous for consumption. For more information see section 3.
- Corrosivity/Irritability: The consumption of a considerable dose can cause irritation in the throat, abdominal pain, nausea and vomiting.

B- Inhalation (acute effect):

- Acute toxicity : Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for inhalation. For more information see section 3.
- Corrosivity/Irritability: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

C- Contact with the skin and the eyes (acute effect):

- Contact with the skin: Not irritating
- Contact with the eyes: Not irritating

D- CMR effects (carcinogenicity, mutagenicity and toxicity to reproduction):

- Carcinogenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for the effects mentioned. For more information see section 3.
  IARC: Distillates (petroleum), hydrotreated light (3)
- Mutagenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Reproductive toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

E- Sensitizing effects:

- Respiratory: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous with sensitising effects. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

F- Specific target organ toxicity (STOT) - single exposure:

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SECTION 11: TOXICOLOGICAL INFORMATION (continued)

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

G- Specific target organ toxicity (STOT)-repeated exposure:

- Specific target organ toxicity (STOT)-repeated exposure: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

H- Aspiration hazard:

Based on available data, the classification criteria are not met. However, it does contain substances classified as hazardous for this effect. For more information see section 3.

Other information:

Not available

Specific toxicology information on the substances:

Identification	Acute toxicity		Genus
Isotridecanol, ethoxylated	LD50 oral	500 mg/kg (ATEi)	Rat
CAS: 69011-36-5	LD50 dermal		
	LC50 inhalation		

SECTION 12: ECOLOGICAL INFORMATION

The experimental information related to the eco-toxicological properties of the product itself is not available

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

12.1 Ecotoxicity:

Not available

12.2 Persistence and degradability:

Not available

12.3 Bioaccumulative potential:

Not available

12.4 Mobility in soil:

Not available

12.5 Results of PBT and vPvB assessment:

Non-applicable

12.6 Other adverse effects:

Not described

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Disposal methods:

Waste management (disposal and evaluation):

Consult the authorized waste service manager on the assessment and disposal operations. In case the container has been in direct contact with the product, it will be processed the same way as the actual product. Otherwise, it will be processed as non-hazardous residue. Waste should not be disposed of to drains. See epigraph 6.2.

Regulations related to waste management:

Legislation related to waste management:

Basel Convention (Hazardous Waste)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 and Amendments

- CONTINUED ON NEXT PAGE -

SECTION 14: TRANSPORT INFORMATION

This product is not regulated for transport.

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations:

Specific provisions in terms of protecting people or the environment:

It is recommended to use the information included in this safety data sheet as data used in a risk evaluation of the local circumstances in order to establish the necessary risk prevention measures for the manipulation, use, storage and disposal of this product.

Industrial Chemicals Act 2019:

Industrial Chemicals (Notification and Assessment) Act 1989

SECTION 16: OTHER INFORMATION

Legislation related to safety data sheets:
This safety data sheet has been designed in accordance with WHS regulations and Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Texts of the legislative phrases mentioned in section 2:
H315: Causes skin irritation.
H318: Causes serious eye damage.

Texts of the legislative phrases mentioned in section 3:
The phrases indicated do not refer to the product itself; they are present merely for informative purposes and refer to the individual components which appear in section 3

WHS:
Acute Tox. 4: H302 - Harmful if swallowed.
Asp. Tox. 1: H304 - May be fatal if swallowed and enters airways.
Eye Dam. 1: H318 - Causes serious eye damage.
Eye Irrit. 2A: H319 - Causes serious eye irritation.
Flam. Liq. 4: H227 - Combustible liquid.
Skin Irrit. 2: H315 - Causes skin irritation.

Advice related to training:
Minimal training is recommended to prevent industrial risks for staff using this product, in order to facilitate their comprehension and interpretation of this safety data sheet, as well as the label on the product.

Principal bibliographical sources:
http://www.safeworkaustralia.gov.au/

Abbreviations and acronyms:
ADG: Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG: International maritime dangerous goods code
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
COD: Chemical Oxygen Demand
BOD5: 5-day biochemical oxygen demand
BCF: Bioconcentration factor
LD50: Lethal Dose 50
CL50: Lethal Concentration 50
EC50: Effective concentration 50
Log-POW: Octanol-water partition coefficient
Koc: Partition coefficient of organic carbon
IARC: International Agency for Research on Cancer

END OF SAFETY DATA SHEET

SECTION 1: IDENTIFICATION

1.1 Product identifier: HCL-15B

Other means of identification:

Not available

1.2 Recommended use of the chemical and restrictions on use:

Relevant uses: Chemical industry. For professional users only.

Uses advised against: All uses not specified in this section or in section 7.3

1.3 Details of manufacturer or importer:

Fusion Technologies (Australia) Pty
Unit 3, 1472 Boundary Road
Wacol, Queensland, 4076 Australia
Phone: +61 460 047 656
https://www.fusiontechinc.net/

Technical Inquries: help@fusiontechinc.net

1.4 Emergency phone number: **AU 1800 033 111 NZ 0800 734 607 (ALL HOURS)**

SECTION 2: HAZARD(S) IDENTIFICATION

2.1 Classification of the hazardous chemical:

WHS:

Classification of this product has been carried out in accordance with Model Work Health and Safety Regulations(Hazardous Chemicals) Amendment 2022

Eye Dam. 1: Serious eye damage, Category 1, H318
Met. Corr. 1: Corrosive to metals, Category 1, H290
Skin Corr. 1A: Skin corrosion, Category 1A, H314
STOT SE 3: Respiratory tract toxicity, single exposure, Category 3, H335

2.2 Label elements, including precautionary statements:

WHS:

Danger

Hazard statements:

Met. Corr. 1: H290 - May be corrosive to metals.
Skin Corr. 1A: H314 - Causes severe skin burns and eye damage.
STOT SE 3: H335 - May cause respiratory irritation.

Precautionary statements:

P234: Keep only in original container.
P280: Wear protective gloves/face protection/protective clothing/respiratory protection/protective footwear.
P301+P330+P331: IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P303+P361+P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P403+P233: Store in a well-ventilated place. Keep container tightly closed.
P501: Dispose of contents and / or containers in accordance with regulations on hazardous waste or packaging and packaging waste respectively.

Substances that contribute to the classification

Hydrochloric acid (10 - <30 %)

2.3 Other hazards which do not result in classification:

Not available

- CONTINUED ON NEXT PAGE -

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

3.1 Mixtures:

Chemical description: Hydrochloric Acid Blend

Components:

In accordance with Schedule 8 (WHS Regulations), the product contains:

Identification	Chemical name/Classification	Concentration
CAS: 7647-01-0	**Hydrochloric acid** Met. Corr. 1: H290; Skin Corr. 1B: H314; STOT SE 3: H335 - Danger	**10 - <30 %**

To obtain more information on the hazards of the substances consult sections 11, 12 and 16.

SECTION 4: FIRST AID MEASURES

4.1 Description of necessary first aid measures:

Request medical assistance immediately, showing the SDS of this product.

By inhalation:

Remove the person affected from the area of exposure, provide with fresh air and keep at rest. In serious cases such as cardiorespiratory failure, artificial resuscitation techniques will be necessary (mouth to mouth resuscitation, cardiac massage, oxygen supply, etc.) requiring immediate medical assistance.

By skin contact:

Remove contaminated clothing and footwear, rinse skin or shower the person affected if appropriate with plenty of cold water and neutral soap. In serious cases see a doctor. If the product causes burns or freezing, clothing should not be removed as this could worsen the injury caused if it is stuck to the skin. If blisters form on the skin, these should never be burst as this will increase the risk of infection.

By eye contact:

Rinse eyes thoroughly with lukewarm water for at least 15 minutes. Do not allow the person affected to rub or close their eyes. If the injured person uses contact lenses, these should be removed unless they are stuck to the eyes, as this could cause further damage. In all cases, after cleaning, a doctor should be consulted as quickly as possible with the SDS of the product.

By ingestion/aspiration:

Request immediate medical assistance, showing the SDS of this product. Do not induce vomiting, because its expulsion from the stomach can be hazardous to the mucus of the main digestive tract, and its inhalation, to the respiratory system. Rinse out the mouth and throat, as they may have been affected during ingestion. In the case of loss of consciousness do not administrate anything orally unless supervised by a doctor. Keep the person affected at rest.

4.2 Symptoms caused by exposure:

Acute and delayed effects are indicated in sections 2 and 11.

4.3 Medical attention and special treatment:

Not available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable extinguishing equipment:

Suitable extinguishing media:

Product is non-flammable under normal conditions of storage, handling and use. In the case of combustion as a result of improper handling, storage or use preferably use polyvalent powder extinguishers (ABC powder), in accordance with the Regulation on fire protection systems.

Unsuitable extinguishing media:

Non-applicable

5.2 Specific hazards arising from the chemical:

As a result of combustion or thermal decomposition reactive sub-products are created that can become highly toxic and, consequently, can present a serious health risk.

5.3 Special protective equipment and precautions for fire fighters:

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SECTION 5: FIREFIGHTING MEASURES (continued)

Depending on the magnitude of the fire it may be necessary to use full protective clothing and individual respiratory equipment. Minimum emergency facilities and equipment should be available (fire blankets, portable first aid kit,...)

Additional provisions:

Act in accordance with the Internal Emergency Plan and the Information Sheets on actions to take after an accident or other emergencies. Destroy any source of ignition. In case of fire, refrigerate the storage containers and tanks for products susceptible to inflammation, explosion or BLEVE as a result of high temperatures. Avoid spillage of the products used to extinguish the fire into an aqueous medium.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures:

For non-emergency personnel:

Isolate leaks provided that there is no additional risk for the people performing this task. Personal protection equipment must be used against potential contact with the spilt product (See section 8). Evacuate the area and keep out those who do not have protection.

For emergency responders:

Wear protective equipment. Keep unprotected persons away. See section 8.

6.2 Environmental precautions:

This product is not classified as hazardous to the environment. Keep product away from drains, surface and underground water.

6.3 Methods and materials for containment and cleaning up:

It is recommended:

Absorb the spillage using sand or inert absorbent and move it to a safe place. Do not absorb in sawdust or other combustible absorbents. For any concern related to disposal consult section 13.

6.4 Reference to other sections:

See sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling:

A.- General precautions for safe use

Comply with the current legislation concerning the prevention of industrial risks. Keep containers hermetically sealed. Control spills and residues, destroying them with safe methods (section 6). Avoid leakages from the container. Maintain order and cleanliness where dangerous products are used.

B.- Technical recommendations for the prevention of fires and explosions

Product is non-flammable under normal conditions of storage, manipulation and use. It is recommended to transfer at slow speeds to avoid the generation of electrostatic charges that can affect flammable products. Consult section 10 for information on conditions and materials that should be avoided.

C.- Technical recommendations on general occupational hygiene

Do not eat or drink during the process, washing hands afterwards with suitable cleaning products.

D.- Technical recommendations to prevent environmental risks

It is recommended to have absorbent material available at close proximity to the product (See subsection 6.3)

7.2 Conditions for safe storage, including any incompatibilities:

A.- Specific storage requirements

Minimum Temp.:	5 ºC
Maximum Temp.:	40 ºC
Maximum time:	6 Months

B.- General conditions for storage

Avoid sources of heat, radiation, static electricity and contact with food. For additional information see subsection 10.5

7.3 Specific end use(s):

Except for the instructions already specified it is not necessary to provide any special recommendation regarding the uses of this product.

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SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 Exposure control measures:

Substances whose occupational exposure limits have to be monitored in the workplace:

There are no applicable occupational exposure limits for the substances contained in the product

8.2 Engineering controls:

A.- Individual protection measures, for example personal protective equipment (PPE)

As a preventative measure it is recommended to use basic Personal Protection Equipment. For more information on Personal Protection Equipment (storage, use, cleaning, maintenance, class of protection,…) consult the information leaflet provided by the manufacturer. For more information see subsection 7.1.
All information contained herein is a recommendation which needs some specification from the labour risk prevention services as it is not known whether the company has additional measures at its disposal.

B.- Respiratory protection

Pictogram	PPE	Remarks
 Mandatory respiratory tract protection	Filter mask for gases and vapours	Replace when there is a taste or smell of the contaminant inside the face mask. If the contaminant comes with warnings it is recommended to use isolation equipment.

C.- Specific protection for the hands

Pictogram	PPE	Remarks
 Mandatory hand protection	Chemical protective gloves (Material: Linear low-density polyethylene (LLDPE), Breakthrough time: > 480 min, Thickness: 0.062 mm)	Replace the gloves at any sign of deterioration.

As the product is a mixture of several substances, the resistance of the glove material can not be calculated in advance with total reliability and has therefore to be checked prior to the application.

D.- Eye and face protection

Pictogram	PPE	Remarks
 Mandatory face protection	Face shield	Clean daily and disinfect periodically according to the manufacturer´s instructions. Use if there is a risk of splashing.

E.- Bodily protection

Pictogram	PPE	Remarks
 Mandatory complete body protection	Disposable clothing for protection against chemical risks	For professional use only. Clean periodically according to the manufacturer´s instructions.
 Mandatory foot protection	Safety footwear for protection against chemical risk	Replace boots at any sign of deterioration.

F.- Additional emergency measures

Emergency measure	Standards	Emergency measure	Standards
 Emergency shower	ANSI Z358-1 ISO 3864-1:2011, ISO 3864-4:2011	 Eyewash stations	DIN 12 899 ISO 3864-1:2011, ISO 3864-4:2011

Environmental exposure controls:

In accordance with the community legislation for the protection of the environment it is recommended to avoid environmental spillage of both the product and its container. For additional information see subsection 7.1.D

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SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties:

For complete information see the product datasheet.

Appearance:

Physical state at 20 ºC:	Liquid
Appearance:	Transparent
Color:	Colourless
Odor:	Pungent
Odour threshold:	Not available *

Volatility:

Boiling point at atmospheric pressure:	100 ºC
Vapour pressure at 20 ºC:	Not available *
Vapour pressure at 50 ºC:	Not available *
Evaporation rate at 20 ºC:	Not available *

Product description:

Density at 20 ºC:	Not available *
Relative density at 20 ºC:	1.074
Dynamic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 20 ºC:	Not available *
Kinematic viscosity at 40 ºC:	Not available *
Concentration:	Not available *
pH:	<1
Vapour density at 20 ºC:	Not available *
Partition coefficient n-octanol/water 20 ºC:	Not available *
Solubility in water at 20 ºC:	Not available *
Solubility properties:	Not available *
Decomposition temperature:	Not available *
Melting point/freezing point:	Not available *

Flammability:

Flash Point:	Non Flammable (>93 ºC)
Flammability (solid, gas):	Not available *
Autoignition temperature:	400 ºC
Lower flammability limit:	Not available *
Upper flammability limit:	Not available *

Particle characteristics:

Median equivalent diameter:	Non-applicable

9.2 Other information:

Information with regard to physical hazard classes:

Explosive properties:	Not available *
Oxidising properties:	Not available *
Corrosive to metals:	H290 May be corrosive to metals.
Heat of combustion:	Not available *
Aerosols-total percentage (by mass) of flammable components:	Not available *

Other safety characteristics:

Surface tension at 20 ºC:	Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

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SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES (continued)

Refraction index: Not available *

*Not available due to the nature of the product, not providing information property of its hazards.

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity:

No hazardous reactions are expected because the product is stable under recommended storage conditions. See section 7 from Safety Data Sheet.

10.2 Chemical stability:

Chemically stable under the indicated conditions of storage, handling and use.

10.3 Possibility of hazardous reactions:

Under the specified conditions, hazardous reactions that lead to excessive temperatures or pressure are not expected.

10.4 Conditions to avoid:

Applicable for handling and storage at room temperature:

Shock and friction	Contact with air	Increase in temperature	Sunlight	Humidity
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

10.5 Incompatible materials:

Acids	Water	Oxidising materials	Combustible materials	Others
Not applicable	Not applicable	Precaution	Not applicable	Avoid alkalis or strong bases

10.6 Hazardous decomposition products:

See subsection 10.3, 10.4 and 10.5 to find out the specific decomposition products. Depending on the decomposition conditions, complex mixtures of chemical substances can be released: carbon dioxide (CO_2), carbon monoxide and other organic compounds.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects:

The experimental information related to the toxicological properties of the product itself is not available

Dangerous health implications:

In case of exposure that is repetitive, prolonged or at concentrations higher than recommended by the occupational exposure limits, it may result in adverse effects on health depending on the means of exposure:

A- Ingestion (acute effect):

- Acute toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for consumption. For more information see section 3
- Corrosivity/Irritability: Corrosive product, if it is swallowed causes burns destroying the tissues. For more information about secondary effects from skin contact see section 2.

B- Inhalation (acute effect):

- Acute toxicity : Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for inhalation. For more information see section 3.
- Corrosivity/Irritability: Prolonged inhalation of the product is corrosive to mucous membranes and the upper respiratory tract

C- Contact with the skin and the eyes (acute effect):

- Contact with the skin: Above all, skin contact may occur as fabrics of all thicknesses can be destroyed, resulting in burns. For more information on the secondary effects see section 2.
- Contact with the eyes: Produces serious eye damage after contact.

D- CMR effects (carcinogenicity, mutagenicity and toxicity to reproduction):

- Carcinogenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for the effects mentioned. For more information see section 3.
  IARC: Not available
- Mutagenicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Reproductive toxicity: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

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SECTION 11: TOXICOLOGICAL INFORMATION (continued)

E- Sensitizing effects:

- Respiratory: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous with sensitising effects. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

F- Specific target organ toxicity (STOT) - single exposure:

Causes irritation in respiratory passages, which is normally reversible and limited to the upper respiratory passages.

G- Specific target organ toxicity (STOT)-repeated exposure:

- Specific target organ toxicity (STOT)-repeated exposure: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.
- Skin: Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

H- Aspiration hazard:

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

Other information:

Not available

Specific toxicology information on the substances:

Not available

SECTION 12: ECOLOGICAL INFORMATION

The experimental information related to the eco-toxicological properties of the product itself is not available

Based on available data, the classification criteria are not met, as it does not contain substances classified as hazardous for this effect. For more information see section 3.

12.1 Ecotoxicity:

Not available

12.2 Persistence and degradability:

Not available

12.3 Bioaccumulative potential:

Not available

12.4 Mobility in soil:

Not available

12.5 Results of PBT and vPvB assessment:

Non-applicable

12.6 Other adverse effects:

Not described

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Disposal methods:

Waste management (disposal and evaluation):

Consult the authorized waste service manager on the assessment and disposal operations. In case the container has been in direct contact with the product, it will be processed the same way as the actual product. Otherwise, it will be processed as non-hazardous residue. Waste should not be disposed of to drains. See epigraph 6.2.

Regulations related to waste management:

Legislation related to waste management:

Basel Convention (Hazardous Waste)
Hazardous Waste (Regulation of Exports and Imports) Act 1989 and Amendments

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SECTION 14: TRANSPORT INFORMATION

Transport of dangerous goods by land:

With regard to ADG Code:

14.1	**UN number:**	UN1789
14.2	**Proper shipping name or Technical Name:**	HYDROCHLORIC ACID
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	III
14.5	**Environmental hazards for Transport Purposes:**	No
14.6	**Special precautions for user**	
	Physico-Chemical properties:	see section 9
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

Transport of dangerous goods by sea:

With regard to IMDG 41-22:

14.1	**UN number:**	UN1789
14.2	**Proper shipping name or Technical Name:**	HYDROCHLORIC ACID
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	III
14.5	**Marine pollutant:**	No
14.6	**Special precautions for user**	
	Special regulations:	223
	EmS Codes:	F-A, S-B
	Physico-Chemical properties:	see section 9
	Limited quantities:	5 L
	Segregation group:	SGG1
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

Transport of dangerous goods by air:

With regard to IATA/ICAO 2024:

14.1	**UN number:**	UN1789
14.2	**Proper shipping name or Technical Name:**	HYDROCHLORIC ACID
14.3	**Transport hazard class:**	8
	Labels:	8
14.4	**Packing Group:**	III
14.5	**Environmental hazards for Transport Purposes:**	No
14.6	**Special precautions for user**	
	Physico-Chemical properties:	see section 9
14.7	**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:**	Not available

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations:

Specific provisions in terms of protecting people or the environment:

It is recommended to use the information included in this safety data sheet as data used in a risk evaluation of the local circumstances in order to establish the necessary risk prevention measures for the manipulation, use, storage and disposal of this product.

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SECTION 15: REGULATORY INFORMATION (continued)

Industrial Chemicals Act 2019:

Industrial Chemicals (Notification and Assessment) Act 1989

SECTION 16: OTHER INFORMATION

Legislation related to safety data sheets:

This safety data sheet has been designed in accordance with WHS regulations and Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Texts of the legislative phrases mentioned in section 2:

H290: May be corrosive to metals.
H318: Causes serious eye damage.
H335: May cause respiratory irritation.
H314: Causes severe skin burns and eye damage.

Texts of the legislative phrases mentioned in section 3:

The phrases indicated do not refer to the product itself; they are present merely for informative purposes and refer to the individual components which appear in section 3

WHS:

Met. Corr. 1: H290 - May be corrosive to metals.
Skin Corr. 1B: H314 - Causes severe skin burns and eye damage.
STOT SE 3: H335 - May cause respiratory irritation.

Advice related to training:

Minimal training is recommended to prevent industrial risks for staff using this product, in order to facilitate their comprehension and interpretation of this safety data sheet, as well as the label on the product.

Principal bibliographical sources:

http://www.safeworkaustralia.gov.au/

Abbreviations and acronyms:

ADG: Australian Code for the Transport of Dangerous Goods by Road and Rail
IMDG: International maritime dangerous goods code
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation
COD: Chemical Oxygen Demand
BOD5: 5-day biochemical oxygen demand
BCF: Bioconcentration factor
LD50: Lethal Dose 50
CL50: Lethal Concentration 50
EC50: Effective concentration 50
Log-POW: Octanol-water partition coefficient
Koc: Partition coefficient of organic carbon
IARC: International Agency for Research on Cancer

END OF SAFETY DATA SHEET