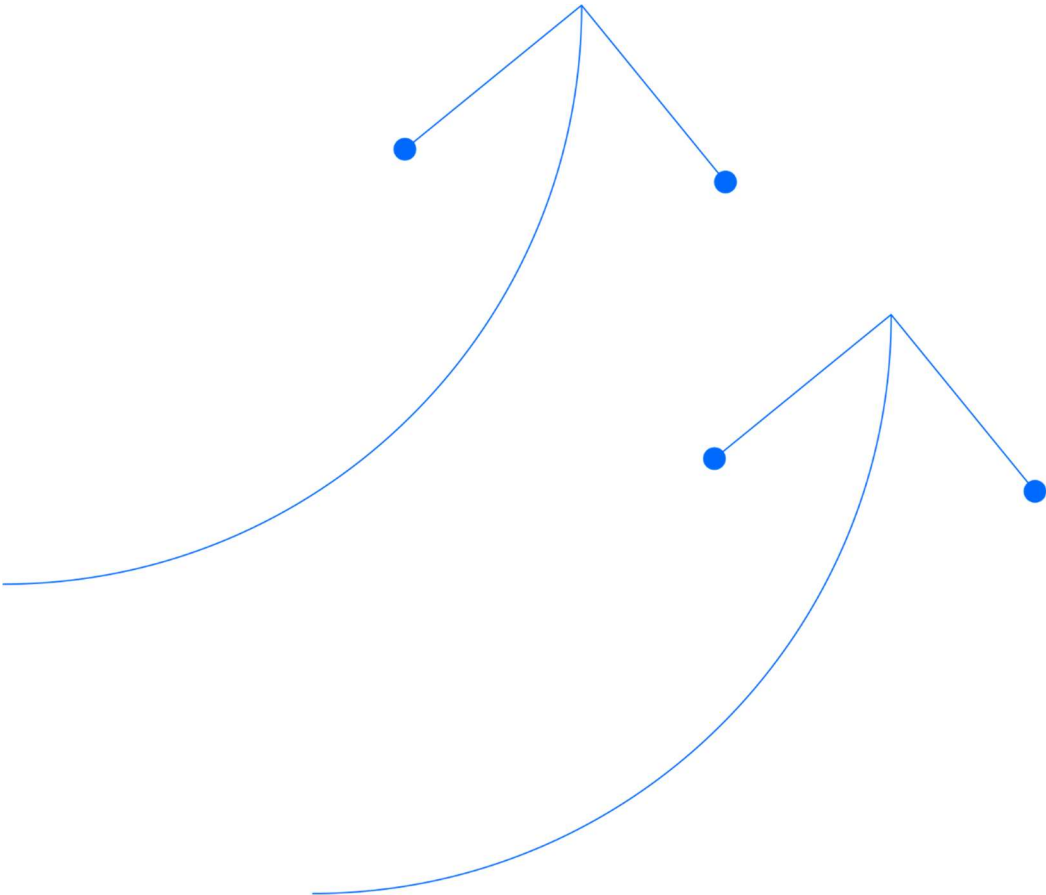


APPENDIX H: METHANE EMISSIONS MANAGEMENT PLAN

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1. Introduction

1.1. Background

This Methane Emissions Management Plan (MEMP) is in support of the EP 161 Beetaloo Basin Appraisal Activity Environmental Management Plan (EMP).

The *Code of Practice for Petroleum Activities in the Northern Territory* (the Code) states that an EMP for a petroleum activity must include a Methane Emissions Management Plan.

1.2. Purpose

This Plan has been developed in accordance with the Code and aims to demonstrate how emissions are reduced to a level that is as low as reasonably practicable (ALARP) and acceptable through effective emissions detection and management. The active monitoring and management measures described below are intended to minimise methane emissions from petroleum activities.

1.3. Definitions and terminology

For the purposes of this plan, “leak” (as defined in the Code) refers to unplanned losses of containment and is addressed within the broader category of fugitive emissions, consistent with Santos’ emissions reporting and external disclosures.

2. Legislation and guidelines

The following legislation, statutory obligations and guidelines were considered during the preparation of this MEMP.

2.1. Code of Practice: Onshore Petroleum Activities in the Northern Territory

The Code sets minimum best practice standards that Interest holders should assess as part of their EMP. The plan is focused on the minimisation and management of any emissions generated from appraisal activities within the Northern Territory (NT).

The Code addresses the following upstream infrastructure:

- Pre-exploration and pre-operation baseline assessments,
- Routine periodic air monitoring,
- Venting and flaring,
- Other emission sources from gas production infrastructure, and
- Reporting requirement.

The Code is designed to be considered and used in conjunction with the Santos’s internal risk assessment process (Appendix O) and operating procedure under Santos safety management systems.

2.2. Code of Practice: Well Integrity 2025

The *Code of Practice: Well Integrity 2025* is applicable to all petroleum operations and well types, including exploration, appraisal, development, monitoring, injection and production wells in conventional and unconventional resources.

Requirements for leak monitoring, detection, classification and reporting are set out in Section 5.2.4. Due to updates to the Code, and for the purposes of this MEMP, Santos has elected to adopt the standards outlined in the *Code of Practice: Well Integrity 2025* for the classification, monitoring, and reporting and response management of leaks.

2.3. National Greenhouse and Energy Reporting Act 2007

The *National Greenhouse and Energy Report Act 2007* require companies that meet certain thresholds to report annually on the greenhouse gas emissions, energy consumption and energy production of facilities under the corporation's operational control.

3. Activity description

Table 1 provides a summary of activities included under this MEMP. For each activity, the relevant emissions and the control measures applied to reduce emissions are described.

Table 1: Activity and emissions description

Activity	Emission description	Controls	Monitoring
Drilling	<ul style="list-style-type: none"> Methane is expected to be encountered, emissions are expected to be small (<1 tonne) and restricted to outgassing of hydrocarbon from intersecting geological formations brought to the surface. 	<ul style="list-style-type: none"> While drilling, the well is kept overbalanced to prevent gas influx from geological formations migrating into the wellbore. 	<ul style="list-style-type: none"> N/A
Hydraulic stimulation	<ul style="list-style-type: none"> During stimulation, the well will be overbalanced restricting the flow of hydrocarbons to surface. 	<ul style="list-style-type: none"> Well is kept overbalanced to prevent gas influx during and after stimulation. Stimulation fluids kept within the formation after each stage (until flowback). 	<ul style="list-style-type: none"> N/A
Flowback and well testing	<ul style="list-style-type: none"> Well is unloaded to allow hydrocarbons and fluid to flow to surface. To minimise methane emissions, flaring will be used rather than venting and venting will only be used where flaring is not feasible. All fluids and hydrocarbons diverted to a separator and then hydrocarbons to a flare onsite. Small emissions (<1 tonne) of methane may be released prior to the onset of flaring, as the hydrocarbon production rate may not be enough to sustain a flare initially. Small volumes (kg's/day) of methane is entrained within liquid hydrocarbons and flowback fluid can't be captured or flared and will be released. 	<ul style="list-style-type: none"> Well heads are designed in accordance with the Code and API standards to minimise loss of methane containment. Gas is sent to a flare during well testing to abate methane emissions. Venting is avoided wherever possible. Calibrated Personal Gas Detectors (PGD) will be used during all operational visits. 	<ul style="list-style-type: none"> Operational personnel will carry and monitor calibrated PGDs during visits to the well site. Emission monitoring will be ongoing during well testing.
Ongoing well operation / suspension	<ul style="list-style-type: none"> Methane emissions restricted to unplanned fugitive emissions from well heads, which may including surface casing venting. 	<ul style="list-style-type: none"> Operation staff to carry PGDs during every routine operational visit to well sites. Routine wellhead maintenance, as per the 	<ul style="list-style-type: none"> PGDs will be used during well-testing works. Leak detection tests will be conducted until

		<p>Interest Holder's standards, will be carried out.</p> <ul style="list-style-type: none"> The well and the equipment on the well pad will be inspected for leaks in accordance with this MEMP and the <i>Code of Practice: Well Integrity 2025</i>. 	<p>well abandonment in accordance with the Code.</p>
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4. Risk assessment

An assessment of environmental impacts and environmental risks posed from the EP 161 Beetaloo Basin Appraisal Activity has been carried out (Appendix O). This risk assessment includes an assessment of the risks posed by methane emissions from undertaking the proposed activities.

For completeness and consistency with the environmental risk assessment of all activities, this is presented in Section 6 of the EMP and Appendix O. As demonstrated in the risk assessment, the controls identified within the risk assessment and Table 1 reduce emissions to ALARP and acceptable.

5. Methane emissions sources and monitoring

5.1. Equipment selection, design standards and maintenance practices

All equipment will be selected to minimise the emissions during exploration activities. Exploration wells and associated surface infrastructure will be designed to mitigate methane emissions in accordance with the relevant standards. The ISO/API standards shown in Table 2 have been adopted for the selection of materials for use during 2019 exploration activities in EP 161.

Detection equipment will be consistent with the Code and the *Code of Practice: Well Integrity 2025*.

Table 2: ISO/API Standards for material selection

Component	Applicable standards
Casing	<ul style="list-style-type: none"> ISO 11960: Steel pipes for use as casing or tubing for wells
Couplings	<ul style="list-style-type: none"> ISO 13679 Procedures for testing casing and tubing connections
Cement and Additives	<ul style="list-style-type: none"> API RP 10B-2 Recommended Practice for Testing Well Cements
Drilling Fluids	<ul style="list-style-type: none"> ISO 10414-1: Recommended Practice for Field Testing Water Based Drilling Fluids API 13B-1 and 13B-2 Recommended Practices
Well Control Equipment	<ul style="list-style-type: none"> API STD 53: Blow-Out Prevention Equipment Systems for Drilling Wells API 16A (ISO 13533): Specification for drill through equipment API 16D: Specification for Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment
Wellheads	<ul style="list-style-type: none"> API 6A: Specification for Wellhead and Christmas Tree Equipment. ISO 10423: Petroleum and Natural Gas Industries - Drilling and Production Equipment - Wellhead and Christmas Tree Equipment

5.2. Methane monitoring methodology and frequency

Santos will ensure the well integrity verification, monitoring and surveillance, and maintenance program includes the systematic monitoring and management of leaks from wells and well equipment into the environment. Detection programs will be undertaken in accordance with the Code (Part D.5.2) and the *Code of Practice: Well Integrity 2025*.

5.2.1. Inspection and monitoring frequency

Routine inspection on all surface infrastructure (e.g. vents, flanges, valves, connections, etc.) aims to detect fugitive methane emissions from surface petroleum activities as soon as practicable so that they can be mitigated. Under the Code, Santos will incorporate the following mandatory requirements:

- (a) Regular visits must be made to operational well sites, gathering systems and processing facilities;
- (b) All operational personnel must carry and monitor personal calibrated gas detectors during every routine operational visit to well sites and processing facilities;
- (c) All persons completing emission detection activities must be properly trained and competency-assured;
- (d) Inspections must be conducted on the minimum frequencies as detailed in Table 3.
- (e) Inspections of individual operating plant must be undertaken at an increased frequency as determined by the risk assessment and in consideration of previous audit/inspection findings for those specific facilities. If required, previous audit/inspection findings will be used to determine future inspection frequency based on risk; and
- (f) If Santos uses optical gas imaging for leak detection, an annual inspection using US EPA Method 21 will also be performed.

Table 3: Emission monitoring and inspection frequency

Activity	Emissions monitoring	Monitoring and inspection frequency
Routine operational inspections	<ul style="list-style-type: none"> • Calibrated personal gas detector • Visual inspection of equipment - including external corrosion, tubular and annular pressures measured 	<ul style="list-style-type: none"> • As required
Drilling	<ul style="list-style-type: none"> • Gas desorption data is collected from target reservoir allowing emission estimates. 	<ul style="list-style-type: none"> • As required
Hydraulic Stimulation	<ul style="list-style-type: none"> • During stimulation, the well will be overbalanced restricting the flow of hydrocarbons to surface. 	<ul style="list-style-type: none"> • N/A
Flowback and Well Testing	<ul style="list-style-type: none"> • Personal gas detectors • Flared gas will be measured by a flow meter. 	<ul style="list-style-type: none"> • Ongoing during well testing. • All operational personnel will carry and monitor personal calibrated gas detectors during every routine operational visit to well sites. • All flared gas measured using flow meters.
Above ground petroleum well pad equipment	<ul style="list-style-type: none"> • Personal gas detectors • USEPA Method 21 or Optical Gas Imaging. 	<ul style="list-style-type: none"> • 6 monthly • All operational personnel will carry and monitor personal calibrated gas detectors during every routine operational visit to well sites.
All gas containing equipment following major maintenance	<ul style="list-style-type: none"> • Personal gas detectors. 	<ul style="list-style-type: none"> • Within 48 hours of recommissioning.

5.3. Leak classification and response management

Leak classification and response management requirements will be implemented as per the *Code of Practice: Well Integrity* (Section 5.2.4).

5.4. Emissions reporting

Emissions reporting will be in accordance with the Part D.6 of the *Code of Practice: Onshore Petroleum Activities*.

Methane may also be released in significant quantities during certain planned and unplanned operations. These include some maintenance operations where gas in pipelines or other equipment is blown down, system upsets or accidental releases. These emissions will be estimated using methods consistent with the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*. Where applicable, the *American Petroleum Institute (API) 'Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry (August 2009)'* will be utilized to estimate emissions from well completions as described in Section 3.15 of the EMP.

Emissions associated with venting and flaring as described in Section D.5.9 of the Code will be consistent with the reporting requirements of the Clean Energy Regulator but will be provided separately to the NT Government each year in accordance with the Section D.6.2 of the Code.

6. References

- USEPA Method 21. US Federal Regulations Title 40 – Protection of Environment Chapter I - Environmental Protection Agency, Subchapter C – Air Programs, Part 60 – Standards of Performance for New Stationary Sources, Appendix A-7 to Part 60—Test Methods 19 through 25E
- Department of Mining and Energy. (2025, February 19). *Code of Practice: Well Integrity*. Retrieved from Petroleum operations codes of practice, forms and guidelines:
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