

MEMORANDUM

| | |
|-----------------|---|
| To | William Inonda, William.Inonda@santos.com |
| From | Sarah Richardson, sarah.richardson@katestone.com.au |
| Client name | Santos |
| Deliverable No. | D24537-3 |
| Subject | Mahalo AQ Information Request |
| Date | 6 February 2026 |

Dear William,

Katestone Environmental Australia Pty Ltd (Katestone) was commissioned by Santos to respond to an Information Request Notice in relation to an air quality assessment report that was prepared by Katestone for the Mahalo Gas Project in the Mahalo Gas Hub in Queensland, namely:

Mahalo Gas Project: Air Quality Assessment Report, Final prepare for Santos June 2025, document reference D24537-2.

The report was lodged as part of the Environmental Authority (EA) amendment application for the Project (application reference number A-EA-AMD-100961118). Santos was issued an Information Request Notice by the Department of Environment, Tourism, Science and Innovation (DETSI) dated 8 December 2025.

DETSI's comments in relation to air quality are reproduced in Attachment A along with Katestone's response. Recommended EA Conditions relating to Schedule D Air are provided in Attachment B.

During the preparation of this memorandum Santos advised that the type and number of power generation units proposed for the site have changed since preparation of the air quality assessment report. Three G3512E units are to be replaced by two slightly larger G3512H units. In addition, the emission concentration for the three G3612 units reported in the original air quality assessment was incorrect due to calculation error in calculating the emission concentration to reference conditions with an incorrect moisture content applied. An assessment of the predicted impact of these changes is provided in Attachment C.

In summary:

- No additional assessment or modelling is required.
- Recommended EA Conditions relating to Schedule D Air have been informed by the air quality assessment report and the dispersion modelling, updated for the proposed change in type and number of power generation units at the compression facility.
- The Project is not anticipated to have a significant impact on air quality at sensitive land uses near to the site.

If you have any questions, please do not hesitate to contact the undersigned.

Kind regards,

Sarah Richardson – Senior Consultant Air Quality

ATTACHMENT A DETSİ COMMENTS

Table A1 Department of Environment, Tourism, Science and Innovation comments

| Department commence | Requested information | Katestone response |
|---|---|---|
| <p>a) Boilers:</p> <p><i>The Executive Summary and section 2 of the Air Quality Assessment report list the inclusion of tri-ethylene glycol (TEG) regeneration boilers that are proposed to be included as part of the infrastructure development for this amendment application. No details are provided of the boiler(s) size and the estimated air emissions.</i></p> | <p><i>Provide further information on:</i></p> <ul style="list-style-type: none"> <i>i. The size of the boilers;</i> <i>ii. The quantity of the boilers;</i> <i>iii. The types of emissions that will be released; and</i> <i>iv. The estimated emissions to air in accordance with the GHG guideline.</i> | <p>Water vapour is removed from the natural gas using a TEG absorption process within a tri-ethylene glycol (TEG) dehydration unit, whereby the lean (low moisture) TEG solution is brought into contact with the wet natural gas to dehydrate the natural gas. The rich (high moisture) TEG solution is then fed to the TEG regeneration boilers to remove the water and regenerate the lean TEG solution for reuse in the dehydration unit.</p> <p>The regeneration boiler section of the TEG dehydration unit operates at high temperatures and low pressures to remove water from the rich TEG solution through evaporation. Waste gases from the stripping process are exhausted via a vent; however, no combustion occurs and emitted species, including nitrogen, carbon dioxide, methane, ethane, water vapour, and TEGlycol, are not a risk for air quality. Emissions are predominantly (approximately 81%) water vapour.</p> <p>Consequently, the TEG regeneration boilers were not required to be considered further in the air quality assessment.</p> |
| <p>b) Air modelling</p> | <p><i>Provide justification that the air modelling undertaken remains appropriate despite the location</i></p> | <p>At the time of the air quality dispersion modelling being carried out, the final location and layout for</p> |

| Department commence | Requested information | Katestone response |
|--|---|--|
| <p>The modelling assumed that all emission sources (i.e. compressors, generators and flare) were modelled at the same location. Application material, however, demonstrates a different proposed development location to that undertaken in the Air Quality Assessment report.</p> | <p>change of the proposed development. Alternatively, provide a revised air modelling assessment that considers the different proposed development locations.</p> | <p>the proposed gas compression facility (GCF) had not been determined. For modelling purposes, all emission sources at the GCF (compressors, generator and flare) were located in the same location. It was concluded that this assumption would not impact the outcome of the assessment due to the distance from site to any sensitive receptors (nearest receptor is approximately 2.3 kilometres whilst all other receptors are more than 5.4 kilometres), the relatively flat terrain of the region, and the scale of the emissions relative to the air quality criteria.</p> <p>After the dispersion modelling had been completed, the proposed location of the GCF changed to be approximately 1 km to the south of the location used in the modelling.</p> <p>As detailed in the air quality assessment report (D24537-2), the change in location is not anticipated to change the outcome of the assessment for routine and non-routine operations. Maximum ground-level concentrations of key air pollutants at nearest sensitive receptors, including NO₂ and CO, are anticipated to remain well below the relevant assessment criteria with the inclusion of ambient background. Specifically, NO₂ is predicted to be less than 6% (1-hour) and 14% (annual) of the relevant criteria, while CO is predicted to be less than 3% (8-hour) of the criteria.</p> |

| Department commence | Requested information | Katestone response |
|--|---|---|
| <p>c) Compressor engines</p> <p><i>It is unclear if the proposed compressor engines will be equipped with an oxidative catalyst. These catalysts are proposed as a mitigation measure to minimise NO_x and CO emissions from exhaust gas; however, the catalyst did not feature in the Air Quality Assessment report.</i></p> | <p><i>Confirm that oxidative catalysts will be included for the compressor engines as part of the emissions reduction scheme of the activity. Otherwise, provide information on proposed alternative mitigation measures to reduce emissions from the compressor engines.</i></p> | <p>Oxidative catalysts are not proposed to be installed on the compressor engines.</p> <p>In absence of any legislation in Queensland that specifies emission concentration limits for plant and equipment, emission standards set in other jurisdictions have been utilised to demonstrate that emissions from the compressor engines are within acceptable limits, and that oxidative catalysts are not anticipated to be required.</p> <p>Emission limits of NO_x for the units are as follows:</p> <ul style="list-style-type: none"> • G3612 - 205 mg/Nm³ @ 7% O₂ • G3512H - 440 mg/Nm³ @ 7% O₂ (G3512H replaces the G3512 assessed in the original air quality assessment.) <p>Noting that the emission concentration reported in the original air quality assessment was incorrect due to calculation error in calculating the emission concentration to reference conditions. Value presented above is the corrected value.</p> <p>Emission limits for the proposed units have been confirmed to satisfy the following emission standards of NO_x:</p> <ul style="list-style-type: none"> • European Union (EU) Directive on the limitation of emissions of certain pollutants into the air from medium combustion plants (2015) |

| Department commence | Requested information | Katestone response |
|---|---|---|
| | | <p>(190 mg/Nm³ @ 15% O₂ (443 mg/Nm³ @ 7% O₂)).</p> <ul style="list-style-type: none"> New South Wales Protection of the Environment Operations (Clean Air) Regulation 2022 (Clean Air Regulation) (450 mg/Nm³ @ 7% O₂). |
| <p>d) Air Quality Assessment Report discrepancies</p> <ul style="list-style-type: none"> The following discrepancies were detected between Appendix D - Air Quality Assessment report and the Supporting Information report: Page 14 of the Air Quality Assessment report considers a 10.9m minimum height for stacks. The proposed amendment, however, states a minimum height at 8 m, in the proposed condition Schedule D, Table 1 – Authorised point sources. The conditioned stack height in Schedule D, Table 1- Authorised point sources is considered to be too low for optimum emission dispersal, and not in accordance with the recommendations for 10.9 m stack heights as concluded in the Air Quality Assessment report. Page 14 of the Air Quality Assessment report reveals the minimum efflux velocity at m/sec at 6.8 m/sec for the G3612 compressors and 19.8 m/sec for the G3512 generators. In the proposed Schedule D, Table 1 – Authorised point sources EA conditions, a 17 m/sec minimum efflux velocity is proposed for compressors 1, 2 and 3; and 6 m/sec minimum efflux velocity is proposed for generators 1, 2 and 3. The proposed Schedule D, | <p>Provide the following information:</p> <ol style="list-style-type: none"> Confirm the proposed minimum stack height for the proposed project activities. Should the proposed minimum stack height differ from the submitted Air Quality Assessment report, provide further justification to demonstrate the risk to receiving air environmental values from the proposed activity's air emissions, including re-modelling of the air emissions using the 8m stack height input. Provide further justification for the proposed minimum efflux velocity of 17 m/sec for the generators and 6 m/sec for the compressors, explaining how these values were determined and why they differ from the recommendations outlined on page 14 of the Air Quality Assessment report. Provide further justification to support the removal of NOx maximum concentrations (mg/Nm³ at 7% O₂) from the G3612 | <p>Proposed EA Licence Conditions for the Project have been revised and are presented in Attachment B.</p> <p>The recommended conditions have been informed by the air quality assessment and dispersion modelling, updated for the proposed change in type and number of power generation units at the compression facility.</p> |

| Department commence | Requested information | Katestone response |
|--|---|--------------------|
| <p><i>Table 1 – Authorised point sources minimum efflux velocity is considered to be too slow for optimum emission dispersal, and not in accordance with the recommendations for 6.8 m/sec for the G3612 compressors and 19.8 m/sec for the G3512 generators as concluded in the Air Quality Assessment report.</i></p> <ul style="list-style-type: none"> <i>Page 14 of the Air Quality Assessment report reveals the NOx (as Nitrogen dioxide) maximum concentration (mg/Nm3 at 7% O2) of 185 for the G3612 compressors and 438 for the G3512 generators. No proposal for NOx maximum concentrations was made for the EA;</i> <i>Page 14 of the Air Quality Assessment report reveals the NOx emission rates (g/sec) of 0.57 g/sec for the G3612 compressors and 0.44 g/sec for the G3512 generators. It is proposed 2 g/s for both the compressors and the generators under Schedule D, Table 1 – Authorised point sources which is significantly higher than what is recommended in the Air Quality Assessment report;</i> <i>Page 14 of the Air Quality Assessment report reveals the CO maximum concentration (mg/Nm3 at 7% O2) of 625 mg/Nm3 for the G3612 compressors and 950 mg/Nm3 for the G3512 generators. No proposal for CO maximum concentrations was made for the EA; and</i> <i>Page 14 of the Air Quality Assessment report reveals the CO emission rates (g/sec) of 1.94 g/sec for the G3612 compressors and 0.96 g/sec for the G3512 generators. No proposal for CO emission rates was made for the EA. Maximum emission limits are typically conditioned in the</i> | <p><i>compressors and G3512 generators. Alternatively, provide maximum concentrations in mg/Nm3 at 7% O2 for NOx for G3612 compressors and G3512 generators.</i></p> <p><i>iv. Provide justification to support the proposed NOx maximum mass emission rates of 2 g/s for both the compressors and the generators under Schedule D, Table 1 – Authorised point sources, as opposed to the significantly lower 0.57 g/s for compression engines and 0.44 g/s for the generators. Alternatively, provide a maximum NOx mass emission rates for G3612 compressors and G3512 generators.</i></p> <p><i>v. Provide further justification to support the removal of CO maximum concentrations (mg/Nm3 at 7% O2) and emission rates (g/sec) from the EA. Alternatively, provide maximum concentrations in mg/Nm3 at 7% O2 for CO.</i></p> <p><i>vi. Provide further justification that demonstrates the appropriateness of the monitoring frequency proposed under Schedule D, Table 1 – Authorised point sources for the compressors and engines.</i></p> | |

| Department commence | Requested information | Katestone response |
|--|-----------------------|--------------------|
| <p><i>EA as a monitoring requirement; the maximum limit assists with the monitoring of the compression and generator engines to ensure appropriate release of contaminants and that the engines are efficiently operating as per standards.</i></p> <ul style="list-style-type: none"> <i>The EA application proposes the following monitoring frequency for the compressors and generators under Schedule D, Table 1 – Authorised point sources: ‘At least one release point must be monitored per year on a rotational basis, with all release points monitored at least once in a 6-year period’. This monitoring frequency does not meet any appropriate standard or manufacturer’s specifications. No further justification was provided as to why this monitoring frequency is appropriate for these engines.</i> | | |

ATTACHMENT B RECOMMENDED EA LICENCE CONDITIONS

SCHEDULE D – AIR

Venting and flaring

- (D1) Unless venting is authorised under the *Petroleum and Gas (Production and Safety) Act 2004* or the *Petroleum Act 1923*, waste gas must be flared in a manner that complies with all of (D1) (a) and (D1) (b) and (D1) (c), or with (D1) (d):
- (a) an automatic ignition system is used, and
 - (b) a flame is visible at all times while the waste gas is being flared, and
 - (c) there are no visible smoke emissions other than for a total period of no more than 5 minutes in any 2 hours, or
 - (d) it uses an enclosed flare.

Fuel burning and combustion facilities

- (D2) If compressor stations meet the definition of fuel burning or combustion equipment, the design of the equipment must be capable of achieving air quality objectives for each environmental value stated in the *Environmental Protection (Air) Policy 2019* and the *Environmental Protection (Air) Amendment Policy 2024*.
- (D3) Fuel burning or combustion equipment must:
- (a) not be operated unless it is listed in *Schedule D, Table 1 – Authorised Releases of Contaminants to Air from Point Sources*
 - (b) not exceed the release limits specified in *Schedule D, Table 1 – Authorised Releases of Contaminants to Air from Point Sources*
- (D4) Point source air monitoring for each fuel burning or combustion facility listed in *Schedule D, Table 1 – Authorised Releases of Contaminants to Air from Point Sources* must:
- (a) be undertaken once:
 - i. in the first three months after first commissioned; and then
 - ii. every year thereafter.
 - (b) be carried out when each unit the subject of the sampling is operated under maximum operating conditions for the annual period; and
 - (c) demonstrate compliance with the limits listed in *Schedule D, Table 1 – Authorised Releases of Contaminants to Air from Point Sources* at each release point reference.

Schedule D, Table 1 – Authorised Releases of Contaminants to Air from Point Sources

| Tenure | Facility | Release Point Locations | Minimum Release Height (m) | Minimum Efflux Velocity (m/s) | NO _x as Nitrogen Dioxide (NO ₂) | | Carbon monoxide (CO) | |
|--------|--------------------|-------------------------|----------------------------|-------------------------------|---|----------------------------------|---|----------------------------------|
| | | | | | Maximum concentration (mg/Nm ³ , 7% O ₂) | Maximum Mass Emission Rate (g/s) | Maximum concentration (mg/Nm ³ , 7% O ₂) | Maximum Mass Emission Rate (g/s) |
| PL1083 | Compressor station | Compressor 1 (G3612) | 10.9 | 6.8 | 205 | 0.57 | 692 | 1.94 |
| | | Compressor 2 (G3612) | 10.9 | 6.8 | 205 | 0.57 | 692 | 1.94 |
| | | Compressor 3 (G3612) | 10.9 | 6.8 | 205 | 0.57 | 692 | 1.94 |
| | | Generator 1 (G3512H) | 10.0 | 27.4 | 440 | 0.56 | 731 | 0.94 |
| | | Generator 2 (G3512H) | 10.0 | 27.4 | 440 | 0.56 | 731 | 0.94 |

Note: The above NO_x and CO release limits are applicable during all timings except start-up, shut down and calibration of emission monitoring devices. The start-up duration is allowed up to 30 minutes.

ATTACHMENT C ASSESSMENT OF CHANGES

C1 Overview

During the preparation of this memorandum Santos advised that the type and number of power generation units proposed for the site have changed since preparation of the air quality assessment report. An error was also identified in the emissions calculations in relation to the moisture content of the exhaust gas for the G3612 unit. An assessment of the predicted impact of this change and the correction of moisture content on the outcome of the air quality assessment is provided in this section.

C2 Emission concentrations - G3612

The emission concentration reported in the original air quality assessment was incorrect due to calculation error in calculating the emission concentration to reference conditions with an incorrect moisture content applied. The original and corrected values are provided in Table C1. The change in emission concentration does not change any of the other parameters used in the dispersion modelling assessment as it was provided for information purposes only. Mass emission rates used in the modelling were based on emissions in g/bhp-hr.

Table C1 Corrected emission parameters from air quality report

| Source | Parameter | Unit | Value in air quality report | Corrected value |
|--------|-------------------------------|---|-----------------------------|-----------------|
| G3612 | NO _x concentration | mg/Nm ³ at 7% O ₂ | 185 | 205 |
| | CO concentration | mg/Nm ³ at 7% O ₂ | 625 | 692 |

C3 Change of power generation units

At the time of the dispersion modelling for the air quality assessment three G3512E units were proposed (reported as G3512 units in air quality report); however, as these units are no longer available, two slightly larger G3512H units are proposed for the site. The height and diameter of the exhaust stack remain unchanged.

Stack characteristics for the G3512 units included in the dispersion modelling, and the proposed G3512H units are presented in Table C2.

The change to two G3512H power generation units is not likely to significantly impact the results of the dispersion modelling, and the results that are presented in the report are anticipated to be representative of the potential worst-case impacts to air quality due to the site and no re-modelling is required. Of relevance:

- An assessment of the total emissions of NO_x and CO from the proposed two slightly larger G3512H units confirms a reduction in total emissions (15% and 35% for NO_x and CO, respectively) compared to the total emissions from three modelled G3512 units.
- Emission limit of NO_x for the proposed G3512H unit satisfies the relevant emission standards of NO_x.
- Stack characteristics, including the location, height and diameter of the exhaust remain unchanged for the two G3512H units.
- The higher exit velocity of the G3512H exhaust plumes (compared to the modelled G3512 units) will result in a greater plume buoyancy and increased dispersion, resulting in lower ground-level concentrations.

Consequently, the conclusions drawn from the air quality assessment report remain, and the Project is not anticipated to have a significant impact on air quality at sensitive land uses near to the site.

Table C2 Emission parameters for modelled and proposed G3512 units

| Parameter | Unit | Value | | Note |
|--|--|--|----------------------|--|
| | | G3512E (previous assessment, reported as G3512) | G3512H (proposed) | |
| Number of units | number | 3 | 2 | Supplied by Santos |
| Stack height | m | 10.0 | 10.0 | |
| Stack diameter | m | 0.45 | 0.45 | |
| Exhaust temperature | °C | 442.0 | 393.0 | As per manufacturer specifications (100% load operation) |
| Exit velocity | m/s | 19.8 | 27.4 | Calculated |
| Actual exhaust volume flow rate | m ³ /s | 3.1 | 4.4 | |
| Moisture content | % | 1.0 | 11.3 | |
| Normalised exhaust volume flow rate | Nm ³ /s (273.15°K, 101.3 kPa, dry, 7% O ₂) | 1.01 | 1.28 | |
| NO _x concentration | g/bkW-hr | - | 1.3 | As per manufacturer specifications (100% load operation) |
| | mg/Nm ³ dry @7% O ₂ | 438 | 440 | Calculated |
| CO concentration | g/bkW-hr | - | 2.16 | As per manufacturer specifications (100% load operation) |
| | mg/Nm ³ dry @7% O ₂ | 950 | 731 | Calculated |
| NO _x emission rate per unit | g/s | 0.44 | 0.56 | |
| CO emission rate per unit | g/s | 0.96 | 0.94 | |
| Total NO _x | g/s | 1.33 | 1.13 | |
| Total CO | g/s | 2.89 | 1.87 | |

C4 Assessment of impact

This section presents the results of the dispersion modelling assessment presented in the previous air quality assessment. The potential impacts due to the Project, including three G3612 gas compressors, two G3512H power generation units, and the enclosed ground flare, would result in ground-level concentrations that are the same, if not lower, than those presented in the air quality assessment report due to a decrease in the total emissions from the facility. Therefore, the findings of the assessment are:

- The nearest receptor is over 2.3 km from the proposed site and the maximum ground-level concentrations of NO₂ and CO predicted in the dispersion modelling were well below the relevant assessment criteria with the inclusion of ambient background, with the results in the air quality report demonstrating that:
 - Cumulative predicted concentrations of NO₂ during routine operations comply with the relevant 1-hour average Air EPP objective and Air NEPM standard of 164 µg/m³, with the highest cumulative concentration at any sensitive receptor less than 6 % of the criteria.
 - Cumulative predicted concentrations of NO₂ during routine operations comply with the relevant annual average Air EPP objective and Air NEPM standard of 31 µg/m³, with the highest cumulative concentration at any sensitive receptor less than 14 % of the criteria.

- Cumulative predicted concentrations of CO during routine operations comply with the relevant 8-hour average Air EPP objective and Air NEPM standard of 11,000 $\mu\text{g}/\text{m}^3$, with the highest cumulative concentration at any sensitive receptor less than 3 % of the criteria.
- Cumulative predicted concentrations of NO₂ during emergency upset operations **comply** with the relevant 1-hour average Air EPP objective and Air NEPM standard of 164 $\mu\text{g}/\text{m}^3$, with the highest cumulative concentration at any sensitive receptor less than 6 % of the criteria.
- Cumulative predicted concentrations of CO during emergency upset operations comply with the relevant 8-hour average Air EPP objective and Air NEPM standard of 11,000 $\mu\text{g}/\text{m}^3$, with the highest cumulative concentration at any sensitive receptor less than 3 % of the criteria.