

Our ref: 12656886

13 October 2025

Stephen Richardson
AllenPrice Pty Ltd
75 Plunkett Street
Nowra

Modification to CO₂ Plant (Supagas) Air Quality Assessment

Dear Stephen

1. Introduction

Supagas own and operate a 90 tonnes per day (TPD) Carbon Dioxide (CO₂) Plant at Bomaderry, NSW. This plant takes CO₂ from the Shoalhaven Starches operations and processes this gas to food grade quality for the food and beverage market. The CO₂ Plant was approved in two stages, i.e. initially 50 TPD and then this was increased to 90 TPD. Supagas propose to undertake alterations and additions to this existing carbon dioxide plant at the same site. This additional plant is proposed to produce 75 TPD of carbon dioxide bringing the total capacity up to 165 TPD.

The plant is located on the Shoalhaven Starches site, i.e. adjacent to the former Dairy Farmers factory that now belongs to the Manildra Group of companies and which Shoalhaven Starches forms a part of. The site is located at 220 Bolong Road, Bomaderry.

GHD Pty Ltd have previously undertaken two assessments of the CO₂ Plant:

- *Shoalhaven Starches Mod 13 Air Quality Assessment (2017)* (now referred to as Mod 15)
- *Proposed modification to CO₂ Plant (Supagas): Air Quality Assessment (2021)* (Mod 20)

These assessments reviewed air quality impacts from the original proposed CO₂ Plant, as well as a modification to this plant to install CO₂ storage vessels and other plant and equipment.

Supagas now wish to undertake further alterations and additions to their existing plant.

Under the existing approvals for this project, it was envisaged that the site would process up to 50 TPD of CO₂ initially for Stage 1 increasing to 100 TPD at maximum processing capacity. To date Supagas' operations process up to 90 TPD at the site.

Supagas have now established the CO₂ Plant on the subject land in accordance with Mods 15 and 20. CO₂ taken directly from Shoalhaven Starches operations under these existing approvals reduce emissions from their operations at present by up to 90 TPD under these approvals.

Supagas propose to now undertake alterations and additions to this existing CO₂ Plant to process and additional 75 TPD of carbon dioxide bringing the total capacity of the plant at the site up to 165 TPD. With this in mind Supagas seek to modify their approval to reflect this refined footprint to accommodate this increase in processing capability.

GHD have been engaged by Supagas to review the proposed changes and advise whether the proposal has the potential to cause significant air quality impacts. The review and assessment are detailed below.

2. Review of proposal and potential emissions

2.1 Site location and sensitive receptors

The existing CO₂ Plant location is shown in Figure 2.1. The CO₂ Plant is located to the northeast of Shoalhaven Starches manufacturing facility. The site is proximate to a number of sensitive receptors. The township of Bomaderry lies to the northwest of the existing Shoalhaven Starches factory and west of the packing plant and the existing CO₂ Plant. Nowra is situated south of the CO₂ Plant.

The nearest receptors to the existing factory, packing plant and environmental farm, and the CO₂ Plant are described in Table 2.1.

Table 2.1 Location of identified sensitive receptors

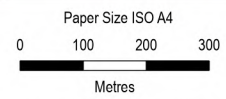
| Receptor ID | UTM coordinates (m) | | Receptor type | Approximate distance and direction from project boundary | Description / additional information |
|-------------|---------------------|-----------|-------------------------|--|--|
| | Easting | Northing | | | |
| R01 | 281,430 | 6,140,610 | Residential | ~150 m west from packing plant | Residential dwelling |
| R02 | 280,400 | 6,139,650 | Residential | ~1300 m southwest from factory | Residential dwelling |
| R03 | 281,510 | 6,139,310 | Residential | ~700 m south from factory | Residential dwelling |
| R04 | 283,000 | 6,139,450 | Residential | ~1300 m south from factory | Residential dwelling |
| R05 | 281,555 | 6,140,828 | Residential | ~100 m northwest from packing plant | Residential dwelling |
| R06 | 281,352 | 6,140,399 | Residential | ~250 m west from packing plant | Residential dwelling |
| R07 | 281,256 | 6,140,441 | Residential | ~300 m west from packing plant | Residential dwelling |
| R08 | 281,043 | 6,140,075 | Residential | ~550 m west from factory | Residential dwelling |
| R09 | 281,236 | 6,139,292 | Residential | ~850 m southwest from factory | Residential dwelling |
| R10 | 281,985 | 6,139,360 | Residential | ~750 m south from factory | Residential dwelling |
| R11 | 282,699 | 6,141,227 | Residential | on western boundary of environmental farm | Residential dwelling |
| R12 | 284,100 | 6,140,721 | Residential | ~160 m east from factory | Residential dwelling |
| R13 | 282,883 | 6,140,388 | Residential | ~400 m southeast from CO ₂ Plant | Residential dwelling |
| C01 | 281,977 | 6,140,501 | Commercial / industrial | ~30 m north from factory | Boc Gases (7am to 5pm, weekdays) |
| C02 | 281,685 | 6,140,373 | Commercial / industrial | ~20 m north from factory | Trackside Takeaway (8am to 5pm, weekdays) |
| C03 | 281,663 | 6,140,373 | Commercial / industrial | ~20 m north from factory | Jim Freeman Plumbing & Southern Industrial Plumbing Group (8am to 5pm, weekdays) |

| Receptor ID | UTM coordinates (m) | | Receptor type | Approximate distance and direction from project boundary | Description / additional information |
|---|---------------------|-----------|-------------------------|--|--|
| | Easting | Northing | | | |
| C04 | 281,615 | 6,140,371 | Commercial / industrial | ~60 m northwest from factory | C & S Frew Fabrications (7am to 4pm, weekdays) |
| C05 | 281,563 | 6,140,372 | Commercial / industrial | ~120 m northwest from factory | Mobil (24 hours) |
| C06 | 281,655 | 6,140,320 | Commercial / industrial | ~20 m west from factory | Cleary Bros Bomaderry (Weekdays: 7am to 5pm, Saturday: 7am to 12pm) |
| C07 | 281,597 | 6,140,289 | Commercial / industrial | ~50 m northwest from factory | Poolside Shoalhaven (Weekdays: 8am to 5pm, Saturday: 8am to 12pm) |
| C08 | 281,181 | 6,139,982 | Commercial / industrial | ~450 m west from factory | Bomaderry Mitre 10 (Weekdays: 7am to 5pm, Saturday: 8am to 4pm, Sunday: 8am to 2pm) |
| C09 | 281,600 | 6,140,601 | Commercial / industrial | on western boundary of packing plant | Kiteleys roofing contractor (Weekdays: 7:30am to 4:30pm, Saturday: 8am to 4pm, Sunday: 8am to 2pm) |
| * Note this location is currently uninhabited | | | | | |



LEGEND

- Sensitive receptors
- CO2 Plant (Supagas)
- APM boundary
- Environmental farm boundary
- Packing plant (proposed) boundary
- Shoalhaven Starches factory boundary



Map Projection: Transverse Mercator
 Horizontal Datum: GDA2020
 Grid: GDA2020 MGA Zone 56

Allen Price Pty Ltd
Supagas Modification Noise Assessment
Air Quality Impact Assessment

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Sensitive receptor locations

FIGURE 2.1

2.2 Existing facility

The existing Supagas operation takes CO₂ from the Shoalhaven Starches operations and then processes this gas to food grade quality for the food and beverage market.

These operations include the following plant and equipment:

- **Cold water scrubber:** This dehumidifies the warm, moist CO₂ existing the raw gas feed and primarily removes water and alcohol from the feed stream.
- **CO₂ compressor:** The CO₂ compressor takes the dry CO₂ from the cold water scrubber and raises the CO₂ pressure to 1950 kPa.
- **Sulphide removal beds:** CO₂ is fed into the columns that contain an active ingredient and removes any organic sulphides. This active ingredient is removed when spent and sent for disposal at an authorised facility.
- **Cat Ox System:** CO₂ is fed through a CATOX (similar to a car exhaust) and all traces of Hydrocarbons are burnt into moisture and CO₂.
- **CO₂ driers:** The CO₂ is further dried to a point where its moisture content is reduced to less than 20 parts per million.
- **CO₂ liquefier:** The gaseous CO₂ at approximately 1800 kPa is liquefied.
- **CO₂ NOx removal vessel:** Liquid CO₂ is run over a bed of molecular sieve. This absorbs any NOx. This is changed every 9 months or so and disposed of in accordance with statutory requirements.
- **CO₂ tanks:** The CO₂ is then currently stored in four storage vessels ranging in volume from 100 kL to 200 kL tanks (providing total storage capacity of 600 kL) awaiting despatch.
- **Distribution:** The CO₂ is then distributed to customers. Distribution of processed product is undertaken either by 2 types of transport combinations. A B-Double capable of carrying a 30-tonne payload and a single tanker that has a capacity of 20 tonnes.

2.3 Proposed modification

Supagas now wish to undertake further alterations and additions to their existing plant.

Under the existing approvals for this project, it was envisaged that the site would process up to 50 TPD of CO₂ initially for Stage 1 increasing to 100 TPD at maximum processing capacity. To date Supagas' operations process up to 90 TPD at the site. Figure 2.2 details the site layout as envisaged under the original approvals for the site.

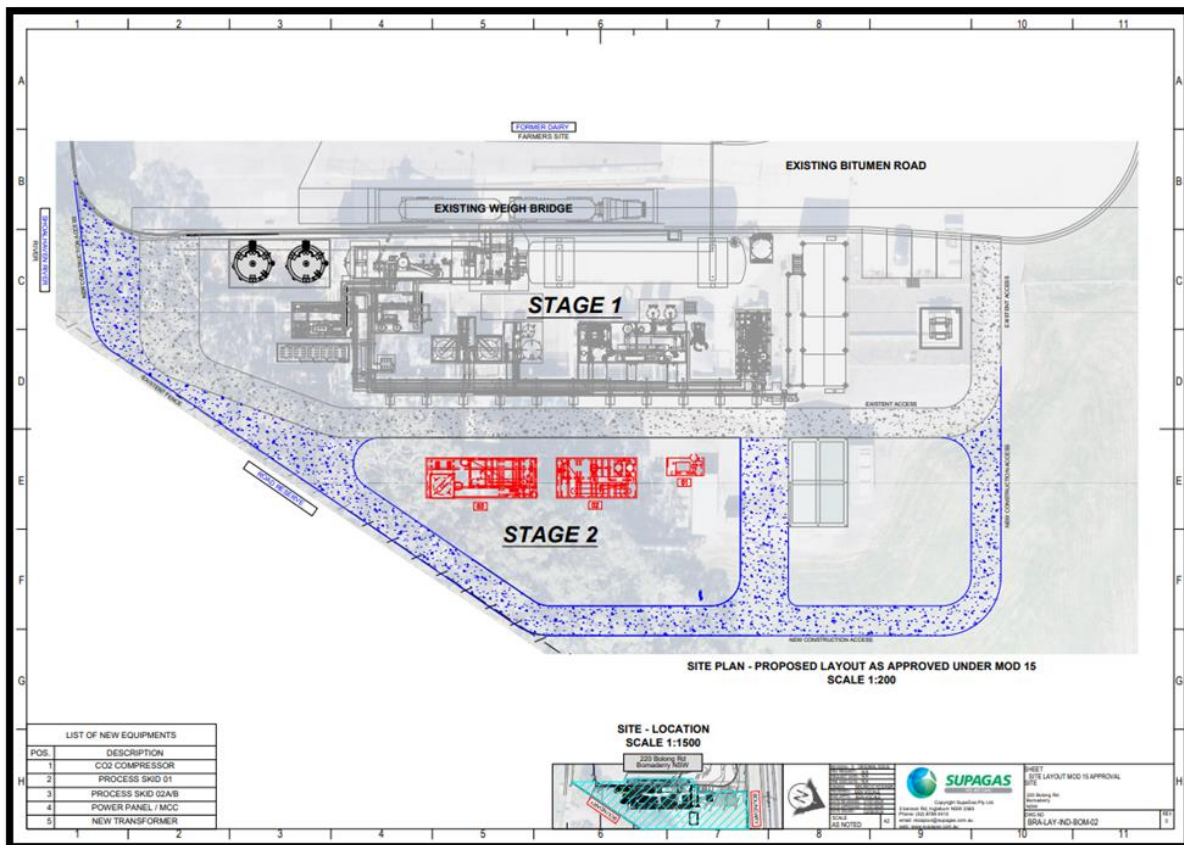


Figure 2.2 CO₂ Plant Stage 2 layout as approved

Supagas have now established the CO₂ Plant on the subject land in accordance with Mods 15 and 20. This facility takes CO₂ from the Shoalhaven Starches operations and processes this gas to food grade quality for the food and beverage market. CO₂ taken directly from Shoalhaven Starches operations under these existing approvals reduce emissions from their operations at present by up to 90 TPD under these approvals.

Supagas propose to now undertake alterations and additions to this existing carbon dioxide plant to process and additional 75 TPD of carbon dioxide bringing the total capacity of the plant at the site up to 165 TPD.

With this in mind Supagas seek to modify their approval to reflect this refined footprint to accommodate this increase in processing capability. The alterations and additions are shown in Figure 2.3 below and will include the following:

- Low pressure / ammonia section
- CO₂ compressor
- Guard carbon bed
- CATOX unit
- Dryer
- Refrigerant compressor
- CO₂ liquefaction
- Ammonia receiver
- NOx trap
- CO₂ liquid pump
- Power panel / MCC
- KO drum
- CO₂ blower
- Transformer
- Cooling towers
- Two (2) additional storage vessels each with a volume of 200 kL, height above ground level of at least 20 metres, diameter of 4.01 metres and a combined volume of 400 kL
- CO₂ vaporisers – A CO₂ vaporiser exchanges heat through a water-circulating and heating system that converts CO₂ liquid into gas.

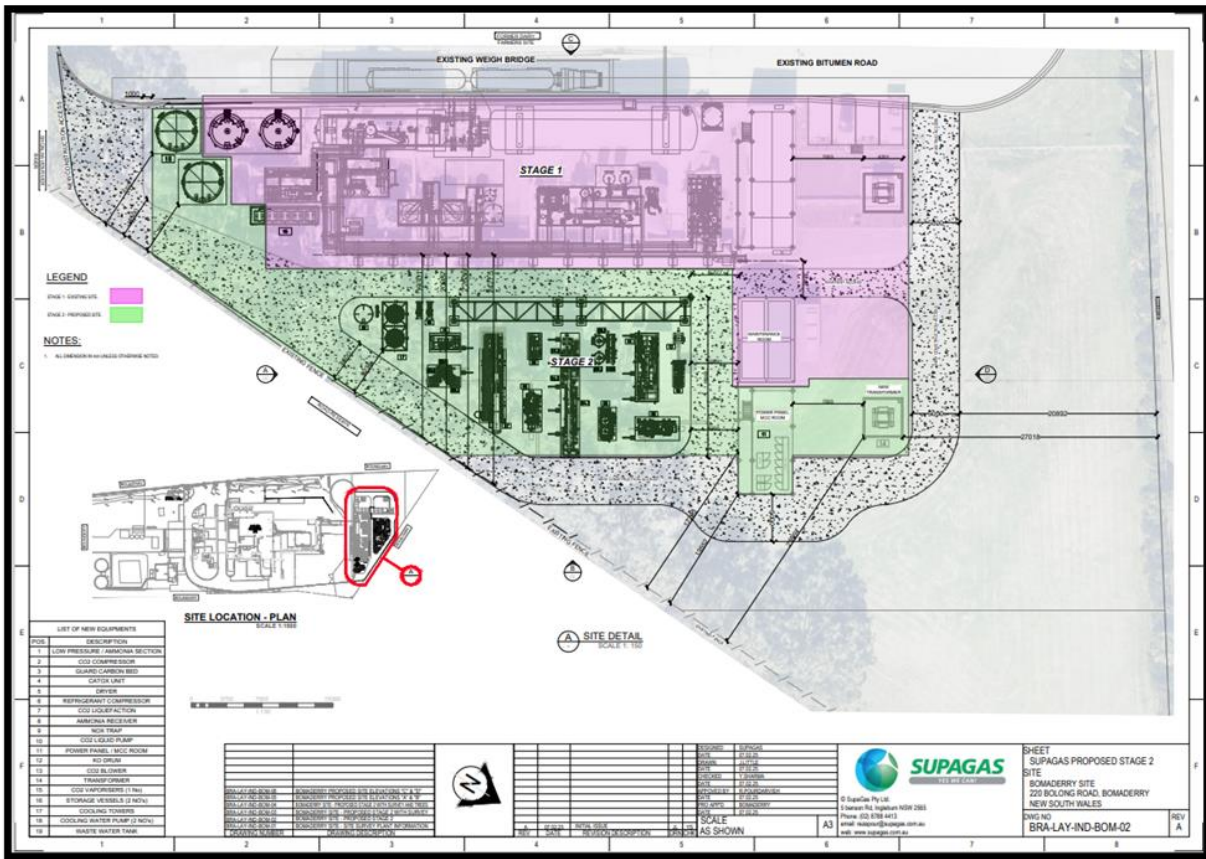


Figure 2.3 Proposed modified CO₂ Plant Stage 2 layout

2.4 Emissions

2.4.1 Existing emissions

A summary of existing plant emissions (as assessed in June 2021) is provided in Table 2.2. The existing system is primarily enclosed and only minor quantities of emissions are anticipated.

Table 2.2 Summary of existing plant emissions

| Description | Flowrate | Temperature (°C) | Concentration (Mole %) | | | | | | |
|---|-------------------------|------------------|------------------------|----------------|----------------|------------------|--------------|-----|----------|
| | | | CO ₂ | O ₂ | N ₂ | H ₂ O | **Oxygenates | pH | Odour |
| Cold scrubber (stream 1) | 1,028 LPH | 17.7 | 0.1 | 0 | 0 | 99.57 | 0.33 | 6.2 | Probable |
| CO ₂ compressor after-cooler condensate drain (stream 2) | 1.8 LPH | 35 | 0.3 | Trace | Trace | 99.7 | Trace | 3.0 | Nil |
| Dehydration unit cooler condensate drain (stream 3) | 10.2 LPH | 9.5 | 0.3 | Trace | Trace | 99.7 | Trace | 3.0 | Nil |
| Drier regeneration gas vent (stream 4) | 60 sm ³ /hr | 0-240 | 65.2 | 5.52 | 29.28 | Nil | Nil | NA | Nil |
| CO ₂ liquefier gas vent (stream 5) | 128 sm ³ /hr | -28.7 | 65.2 | 5.52 | 29.28 | Nil | Nil | NA | Nil |
| Cooling tower blow-down (stream 6) | 90 LPH | 30 | Trace | Trace | Trace | 100 | Nil | 6.8 | Nil |

**oxygenates comprises of a mixture of compounds given below in varying proportions with the predominate species being ethanol

The previous assessments noted the following:

- Streams 1, 2, 3 and 6 are liquid and are composed primarily of H₂O.
- Stream 1 (cold scrubber drain) is estimated to have vapour comprising of a number of potentially odorous oxygenated chemical compounds including Ethanol, Acetaldehyde and Ethyl Acetate. Supagas have advised that vapour exiting the cold scrubber is sent down the pipeline to the CO₂ plant on the Meats Works Site for further treatment. Therefore this stream will not be a source of odorous or toxic emissions.
- Stream 2 (CO₂ compressor after-cooler condensate drain) may contain trace levels of oxygenated chemical compounds, however this stream of up to 1.8 litres per hour (99.7% H₂O and 0.3% CO₂) is not a significant quantity to be a source of odorous emissions.
- Stream 3 (dehydration unit cooler condensate drain) and Stream 4 (Drier regeneration gas vent) contain no odorous or toxic air pollutants.
- The two sources of gaseous emissions are Stream 4 (Drier regeneration gas vent) and Stream 5 (CO₂ liquefier gas vent) and contain no odorous or toxic air pollutants

- The vapour exiting the cold scrubber is piped to the purification plant via a closed pipe. The gas is then purified using a number of absorbers and a reactor is used to removed 'low level' impurities. No gas is vented until it gets to the distillation section. All possible odours have been removed at that point.
- No short-term increase in emissions would be anticipated when the CO₂ NO_x removal beds are changed over as the NO_x is a chemical reaction with the media and remains with the media.

2.4.2 Proposed modification

A summary of plant emissions from the proposed modification is provided in Table 2.3. Where changes are anticipated from the existing plant emissions presented in Table 2.2, these are shown in **blue bold**.

Table 2.3 Summary of proposed plant emissions

| Description | Flowrate | Temperature (°C) | Concentration (Mole %) | | | | | | |
|---|------------------------------|------------------|------------------------|----------------|----------------|------------------|--------------|-----|----------|
| | | | CO ₂ | O ₂ | N ₂ | H ₂ O | **Oxygenates | pH | Odour |
| Cold scrubber (stream 1) | 3,206 LPH | 17.7 | 0.1 | 0 | 0 | 99.57 | 0.33 | 6.2 | Probable |
| CO ₂ compressor after-cooler condensate drain (stream 2) | 3.6 LPH | 35 | 0.3 | Trace | Trace | 99.7 | Trace | 3.0 | Nil |
| Dehydration unit cooler condensate drain (stream 3) | 20.4 LPH | 9.5 | 0.3 | Trace | Trace | 99.7 | Trace | 3.0 | Nil |
| Drier regeneration gas vent (stream 4) | 120 sm³/hr | 0-240 | 65.2 | 5.52 | 29.28 | Nil | Nil | NA | Nil |
| CO ₂ liquefier gas vent (stream 5) | 256 sm³/hr | -28.7 | 65.2 | 5.52 | 29.28 | Nil | Nil | NA | Nil |
| Cooling tower blow-down (stream 6) | 180 LPH | 30 | Trace | Trace | Trace | 100 | Nil | 6.8 | Nil |

**oxygenates comprises of a mixture of compounds given below in varying proportions with the predominate species being ethanol

Changes from the existing plant emissions include a doubling of the flow rates for all streams except for stream 1, which is approximately three times the existing flow rate.

3. Legislation and criteria

The *Protection of the Environment Operations Act 1997* (POEO Act 1997) establishes, amongst other things, the procedures for issuing licences for environmental protection in relation to aspects such as waste, air, water and noise pollution control. The owner or occupier of premises engaged in scheduled activities is required to hold an EPL and comply with the conditions of that licence.

The POEO Act 1997 requires that no occupier of any premises causes air pollution (including odour) through a failure to maintain or operate equipment or deal with materials in a proper and efficient manner.

The operator must also take all practicable means to minimise and prevent air pollution (sections 124, 125, 126 and 128 of the POEO Act 1997).

The POEO Act 1997 includes the concept of 'offensive odour' (section 129) and states it is an offence for scheduled activities to emit 'offensive odour'.

The National Environment Protection Council of Environmental Ministers, now the National Environment Protection Council (NEPC), set uniform national standards for ambient air quality. The document containing these standards is known as the National Environment Protection (Ambient Air Quality) Measure 2021 (the Air NEPM), which also contains goals for the identified relevant pollutants inclusive of particulates and concentration limits, averaging periods, and number of allowed exceedances for each of the identified pollutants.

The *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW EPA, 2022) lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW. It considers the above-mentioned legislation and guidance to provide pollutant assessment criteria.

The Institute of Air Quality Management's *Guidance on the assessment of dust from demolition and construction* (Institute of Air Quality Management, 2024) provides guidance on the assessment of dust from demolition and construction activities. It provides a qualitative step by step process to assess the risk of dust impacts.

Shoalhaven Starches operate as per Environmental Protection Licence Number 883 that states they must not cause or permit the emission of offensive odour beyond the boundary of the premises. Previous odour assessments undertaken for Shoalhaven Starches show that the site is currently predicted to comply with the odour criterion at the assessed nearby receptors.

4. Potential impacts

4.1 Construction

4.1.1 Overview

It is understood that the proposed modification will involve construction of the proposed Stage 2 works, as well as installation of two additional storage vessels and other plant and equipment. The indicative construction footprint with a 250 metre buffer zone is shown in Figure 4.1).

The key emissions to air from the construction of the proposed modification were identified upon review of the construction methodology. Low levels of dust emissions (TSP and PM₁₀) are expected during construction efforts, primarily from:

- Earthworks – civil works
- Construction – installation of the equipment skid, installation of the pipe bridge and interconnection of the skid
- Track-out – Wheel generated dust from truck delivery supplies to the construction area. Construction traffic generation is expected to comprise of no more than 4 truck trips generated per day.

Minor vehicle exhaust emissions are expected throughout the construction period; however, sources will be discontinuous, transient, and mobile, and therefore the air quality risk associated with vehicle emissions during construction is low.

No significant demolition works are proposed.

4.1.2 Assessment approach

A risk-based approach in accordance with IAQM guidance was adopted to assess potential particulate matter impacts during the construction of the proposed modification.

The IAQM guidance recommends that a detailed risk assessment be undertaken where there is a human receptor within 250 m or an ecological receptor within 50 m of the construction footprint, or where there is a human or ecological receptor within 50 m of any haulage routes up to 250 m from the site entrance.

Given there are no human receptors within 250 m of the construction footprint (refer to Figure 4.1), a detailed risk assessment has not been undertaken.

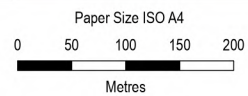
4.1.3 Risk summary

Due to the distance between the construction works and the nearest sensitive receptors, the risk for all construction activities is considered negligible and specific mitigation measures are not required.



LEGEND

- Sensitive receptors
- Indicative construction area
- CO2 Plant (Supagas)
- 250 m construction buffer



Map Projection: Transverse Mercator
 Horizontal Datum: GDA2020
 Grid: GDA2020 MGA Zone 56



Allen Price Pty Ltd
Supagas Modification Noise Assessment
Air Quality Impact Assessment

**Indicative location of proposed
 construction works with buffer distance**

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FIGURE 4.1

4.2 Operation

GHD has reviewed the project information and potential emissions associated with the modification. Although flow rates are proposed to increase through all streams, no changes to the outlet gas composition from each stream are proposed.

Emitted pollutants which may have an impact on human health include CO₂, ammonia and odour, as identified in the *Revised Preliminary Hazard Analysis, Alterations and Additions to an Existing Carbon Dioxide Plant, Supagas (Shoalhaven Starches Site, Bomaderry, NSW)* (Pinnacle Risk Management, 2025) (the PHA).

Based on the flow rate and concentration of CO₂ described in Table 2.3, the following emissions of CO₂ are proposed:

- 3.4 TPD of CO₂ from stream 4
- 7.3 TPD of CO₂ from stream 5

Noting that only streams 4 and 5 vent to the atmosphere. This assumes atmospheric pressure (1 atm) and ambient temperature of 20 °C.

The proposed modification to the CO₂ Plant will allow for extraction and processing of 75 TPD, leading to an overall reduction in emitted CO₂.

Ammonia is located within a sealed system with no anticipated venting. Emissions of ammonia would occur only during maintenance approximately once every six months, with minimal emissions associated.

The PHA presents a detailed risk assessment including risk from emissions of CO₂ and ammonia, and all risks associated with the modified Supagas CO₂ Plant were concluded to be acceptable.

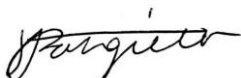
Emissions from the cold scrubber (stream 1) are the only source with potential for odour impacts. The vapour exiting the cold scrubber is piped to the purification plant via a closed pipe. The gas is then purified using a number of absorbers and a reactor is used to removed 'low level' impurities. No gas is vented until it gets to the distillation section. All possible odours have been removed at that point. Therefore an increase in flow to the cold scrubber is not anticipated to lead to odour impacts at the nearby sensitive receptors.

Based on the information provided there will be no construction or operational air quality impacts on any nearby sensitive receptors.

5. Conclusion

GHD has undertaken a review of the proposed changes to the CO₂ Plant including any impacts on site emissions. Air quality impacts during construction (dust) and operation (odour and other pollutants) are not anticipated and there is no expected increase to the cumulative levels in the local area.

Regards



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6. References

- Institute of Air Quality Management. (2024, January). IAQM Guidance on the assessment of odour for planning. London.
- NSW EPA. (2022, August). Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales. Parramatta, NSW: NSW Environment Protection Authority.
- Pinnacle Risk Management. (2025). *Revised preliminary hazard analysis, alterations and additions to an existing carbon dioxide plant, Supagas (Shoalhaven Starches site), Bomaderry, NSW.*