Australia Pacific LNG Project

Volume 2: Gas Fields

Chapter 13: Air Quality

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13.1 Introduction

13.1.1 Purpose

The purpose of this assessment is to describe the potential effect of the construction and operation of the Australia Pacific LNG Project (the Project) gas fields on ambient air quality, and identify suitable mitigation and management measures to address potential impacts. The assessment of the potential impact of air emissions from the gas fields' activities has been conducted in accordance with the environmental impact statement (EIS) terms of reference for the Project. A detailed air quality assessment is provided in Volume 5 Attachment 28.

Development of the gas fields will result in air emissions during the construction, operational and decommissioning phases of the Project. Australia Pacific LNG's sustainability principles will be applied to the planning, design, construction and operation of the gas fields to ensure air emissions do not adversely impact people or the environment.

Of Australia Pacific LNG's 12 sustainability principles, the key principles in relation to the air quality of the gas fields include:

- Minimising adverse environmental impacts and enhancing environmental benefits associated with Australia Pacific LNG's activities, products or services; conserving, protecting, and enhancing where the opportunity exists, the biodiversity values and water resources in its operational areas
- Identifying, assessing, managing, monitoring and reviewing risks to Australia Pacific LNG's workforce, its property, the environment and the communities affected by its activities.

The quality of the air over the gas fields is relatively good, given that the region is predominantly rural in nature. The sustainability principles as applied to air quality mean that Australia Pacific LNG will seek to control emissions from project activities to ensure ambient air quality is not degraded such that there is no potential for adverse health effects or environmental harm.

Australia Pacific LNG will manage air emissions and dust generation associated with all activities through the design and operation of fixed plant and mobile equipment, control of fugitive gas emissions, limiting gas venting and flaring and compliance with environmental management plans. This will entail application of industry best practice air emission reduction and treatment technology, as appropriate to meet the air quality objectives set down in the Queensland Environmental Protection (Air) Policy 2008.

13.1.2 Scope of work

The assessment of potential impact of air emissions associated with the gas fields' development includes:

- Sources, nature and quantity of air emissions
- Ambient air quality of the gas fields area that might be affected by the Project
- Atmospheric dispersion modelling methodology applied to the study
- Air quality impact assessment for both normal and abnormal (upset) operating conditions

- Cumulative impacts of air emissions from the Project as well as other planned coal seam gas developments over the central gas fields' area southwest of Chinchilla.

The primary source of air emissions within the gas fields' development area include:

- Gas-fired engines used to drive wellhead pumps
- Gas-fired engines used to drive the gas compressors at the gas processing facilities
- Gas-fired engines used to drive the water pumps at the water transfer stations for the transfer of water from the wellhead to the water treatment facilities
- Gas-fired engines used to generate electrical power at the gas processing facilities and water treatment facilities
- Gas-fired boilers used to regenerate the tri-ethylene glycol used in the gas dehydration units.

The assessment has also considered the potential for impacts to air quality during abnormal or upset operating conditions when gas may be vented through the flares for combustion at the gas processing facilities.

In addition, air emissions associated with construction and transport activities will include emissions from internal combustion engines, drilling and well completion, as well as dust generated from earthmoving activities and vehicle movements on unpaved roads.

Greenhouse gas emissions associated with the gas fields' element of the Project are discussed in Volume 2 Chapter 14.

13.1.3 Legislative framework

The *Environmental Protection Act 1994* provides the framework for the management of the air environment in Queensland. The Environmental Protection (Air) Policy 1997 was made under the Act and gazetted in 1997. This policy was subsequently reviewed and the Environmental Protection (Air) Policy 2008 (EPP Air) came into force on 1 January 2009.

The objective of the EPP Air is:

> *'...to identify the environmental values of the air environment to be enhanced or protected and to achieve the object of the Environmental Protection Act 1994, i.e., ecologically sustainable development' (EPP Air Explanatory Notes).*

The environmental values to be enhanced or protected under the EPP Air are the qualities of the air environment that are conducive to:

- Protecting the health and biodiversity of ecosystems
- Human health and wellbeing
- Protecting the aesthetics of the environment, including the appearance of buildings structures and other property
- Protecting agricultural use of the environment.

The administering authority must consider the requirements of the EPP Air when it decides an application for an environmental authority, amendment of a licence or approval of a draft environmental management plan. Schedule 1 of the EPP Air specifies air quality objectives for various averaging periods.

Where an air quality objective for a particular pollutant is not published in the EPP Air, an appropriate objective from other jurisdictions has been used. These include:

- National Environment Protection Measure (Ambient Air Quality) 1998, produced by the National Environment Protection Council
- NSW Department of Environment and Climate Change 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2005)'
- EPA Victoria 'State Environment Protection Policy (Air Quality Management) 1999'
- World Health Organisation 'Guidelines for Air Quality (Chapter 3) 2000'
- Toxicological section list in 'Effects Screening Levels 2007', produced by the Texas Commission on Environmental Quality
- National Occupational Health and Safety Commission's National Exposure Standards for Atmospheric Contaminants in the Occupational Environment (NOHSC: 1003(1995)).

13.2 Methodology

The air quality impact assessment for the Project has been undertaken in accordance with the requirements of the EIS terms of reference for the Project. The assessment is based on a dispersion modelling study incorporating source characteristics and air pollutant emission rates. This information incorporates the Project's pre-front-end engineering and design parameters and site-specific meteorology based on prognostic meteorological modelling with the assimilation of local observation of data.

Detailed information on the impact assessment methodology is provided in the air quality technical report in Volume 5 Attachment 28. The following summarises the key aspects of the atmospheric dispersion modelling applied to the gas fields' development.

The existing environment in the region is described in terms of:

- Climate including temperature, solar exposure, relative humidity, rainfall and atmospheric pressure
- Meteorology including wind speed and direction
- Terrain and land use and location of sensitive receptors
- Ambient air quality, including nitrogen dioxide (NO_2), sulphur dioxide and particulate matter with an aerodynamic diameter less than ten microns (PM_{10}) based on the Queensland Department of Environment and Resources Management monitoring data at Toowoomba
- Ambient air quality for NO_2, based on the modelling of background oxides of nitrogen (NO_X) sources such as existing power stations in the region.

The atmospheric dispersion modelling included:

- Generation of a regional meteorology model over an area of 350km by 350km
- Incorporation of the meteorological data recorded at Miles, Dalby and Applethorpe
- Generation of a local meteorological model in the central gas fields' area southwest of Chinchilla
- Incorporation of emissions from existing industry in the region such as coal- and gas-fired power stations

- Assessment of all major pollutants emitted from the gas fields using an approved air dispersion model
- Cumulative impact assessment for key pollutants to allow comparison of potential total pollutant load in the region with ambient air quality objectives
- Investigation of mitigation measures.

13.3 Existing environment

13.3.1 Climate

The climatic conditions over the gas fields, particularly in relation to the generation of dust and the transport and dispersion of air pollutants, are presented in Volume 2 Chapter 4.

In summary, the climate across the Project's gas fields can be described as follows:

- Sub-tropical, semi-arid with warm and wetter summers relative to mild and drier winters
- Average daily maximum temperatures range between 20 to 33^{o}C
- average daily minimum temperatures range between 4 to 20^{o}C
- Average annual rainfall ranges between 558 to 668mm
- The prevailing wind direction across the gas fields is from the north to northeast all year round, with significant winds from the south to southwest during autumn and winter.
- Moderate wind speeds between two to five metres per second dominate, with a high percentage of calm conditions recorded across the region, particularly at Miles.

13.3.2 Ambient air quality

The Queensland Department of Environment and Resource Management monitors ambient air quality in major population centres to assess compliance against the National Environment Protection (Ambient Air Quality) Measure and the EPP Air. The closest departmental monitoring station to the study area is located in Toowoomba. Comprehensive air quality monitoring data is available from the air quality monitoring station in Toowoomba. The existing air quality in the region is likely to be fairly good due to the predominantly agricultural land use.

The most significant sources of air pollutants to the existing regional air quality are the power stations and dust from agricultural activities. The effect of power stations on the existing environment is expected to be relatively minor within the gas fields due to the significant distances between, and geographical locations of, these industries.

The existing infrastructure at the Talinga gas processing facility includes twelve rich-burn engines that have relatively high local emissions of NO_X in the central gas fields.

13.4 Potential impacts

13.4.1 Construction

Emissions generated during construction activities are likely to consist of engine exhausts from vehicles and diesel generators and from dust generated by earthworks and vehicle movements on

sealed and unsealed roads. The composition of engine exhaust emissions is expected to be primarily NO_X and carbon monoxide with small quantities of hydrocarbons.

These emissions have been considered in a qualitative assessment due to the relatively low emission rates of mobile vehicles in comparison to the significant operational emissions from the gas fields and the short duration and transient nature of these emissions during project construction. Gaseous emissions to air during these phases will be relatively minor compared to those from the operation of the gas fields.

Greenhouse gas emissions related to gas fields' construction activities have been assessed quantitatively and are discussed in Volume 2 Chapter 4.

13.4.2 Operation

The following key air pollutants are likely to be emitted within the Australia Pacific LNG gas fields:

- NO_X as nitrogen dioxide
- Sulphur dioxide
- Carbon monoxide
- Particulate matter with an aerodynamic diameter less than ten microns (PM_{10})
- Hydrocarbons.

The Queensland Department of Environment and Resource Management has not set emission concentration standards for sources of air pollution such as fuel burning activities. The Queensland legislation requires that air pollutants are minimised through the application of 'best practice environmental management'. Further, the terms of reference for the Project requires that the air quality impact assessment should include a comparison of the predicted level of emissions with the best practice national source emission standards.

New South Wales provides standards of emission concentrations for scheduled premises in the Protection of the Environment Operations (Clear Air) Regulation (2002). In the absence of Queensland regulatory limits for stationary sources, Australia Pacific LNG has compared the predicted project emissions with these standards. The standards for stationary reciprocating internal combustion engines and gas-fired boilers from these regulations are provided in Volume 5 Attachment 28.

Air quality impacts

The assessment of potential effects on air quality associated with emissions from significant combustion sources has been carried out using atmospheric dispersion modelling across the Project's gas fields. The dispersion modelling assessment has been carried out for the engines at all proposed facilities operating at maximum capacity, which represents the highest rate of emissions load and, consequently, the highest potential ground-level concentrations. This is a conservative approach given that not all facilities are required to be built in order to supply sufficient CSG for the LNG facility.

To ensure that ambient air quality objectives are met with the addition of the Australia Pacific LNG gas fields' infrastructure, non-selective catalytic reduction technology or another appropriate technology may be required, if the Talinga facility is expanded. Use of such emission control technology can achieve the following emission reductions for the rich-burn reciprocating engines: NO_X (90% reduction), carbon monoxide (80%) and hydrocarbons (50%).

The predicted maximum incremental and cumulative ground-level concentrations of criteria air pollutants are presented in Table 13.1 compared to the EPP Air objectives. Values presented in this table represent the maximum ground-level concentration anywhere within the Project's gas fields based on assessment of all emissions under normal operating conditions. Cumulative ground-level concentrations of NO_2 include existing power stations in the region.

Table 13.1 Predicted concentrations of criteria air pollutants

Pollutant	Averaging period	EPP Air objective (µg/m³)	Predicted maximum incremental concentration		Predicted maximum cumulative with background	
			Maximum on grid (µg/m³)	Percent of objective (%)	Maximum on grid (µg/m³)	Percent of objective (%)
Nitrogen dioxide	1-hour	250	241.2	96.5	241.2	96.5
	Annual	62	4.0	6.5	4.2	6.8
Carbon monoxide	8-hour	11,000	536.0	4.9	591.0	5.4
Sulphur dioxide	1-hour	570	0.3	0.04	-	-
	24-hour	230	0.02	0.01	-	-
	Annual	57	0.001	0.00002	-	-
PM_{10}	24-hour	50	0.2	0.4	14.2	28.4
$PM_{2.5}$	24-hour	25	0.2	0.9	5.3	21.3
	Annual	8	0.01	0.1	5.1	63.9

The results of air quality modelling include the following key findings:

- Nitrogen dioxide was found to be the most significant air pollutant. Predicted ground-level concentrations of NO_2 due to the gas fields activities are expected to be below the EPP Air's air quality objectives at sensitive locations during normal operations accounting for existing sources of NO_2 in the region as shown in Figure 13.1.
- Predicted ground-level concentrations of carbon monoxide and all other air pollutants due to gas fields' activities are likely to be below the EPP Air's air quality objectives at sensitive locations during normal operations.
- The total cumulative impacts have been assessed at the central gas fields where the cumulative impact is most likely to occur. Cumulative impacts include the Australia Pacific LNG Project and existing and other proposed CSG facilities and power stations in the region. The maximum ground-level concentration of NO_2 predicted at any sensitive receptor location in this area is well below the EPP Air's air quality objectives for the 1-hour and annual averages.
- The predicted ground-level concentrations of all air pollutants associated with flaring are predicted to be below the air quality objectives during the operation of the gas flares. This includes the use of all flares simultaneously while all other infrastructure is operating under normal conditions, which is a conservative approach.

- The maximum 1-hour average ground-level odour concentration across the gas fields associated with air emissions from project activities is predicted to be below the 'environmental guideline: a procedure to assess the risk of odour nuisance from proposed developments, Queensland EPA, 1999'.
- The predicted maximum ground level concentrations of NO_2 are also expected to be well below the EPP Air's air quality objectives for the health and biodiversity of ecosystems, which is 33 micrograms per cubic metre (µg/m³) annual average.

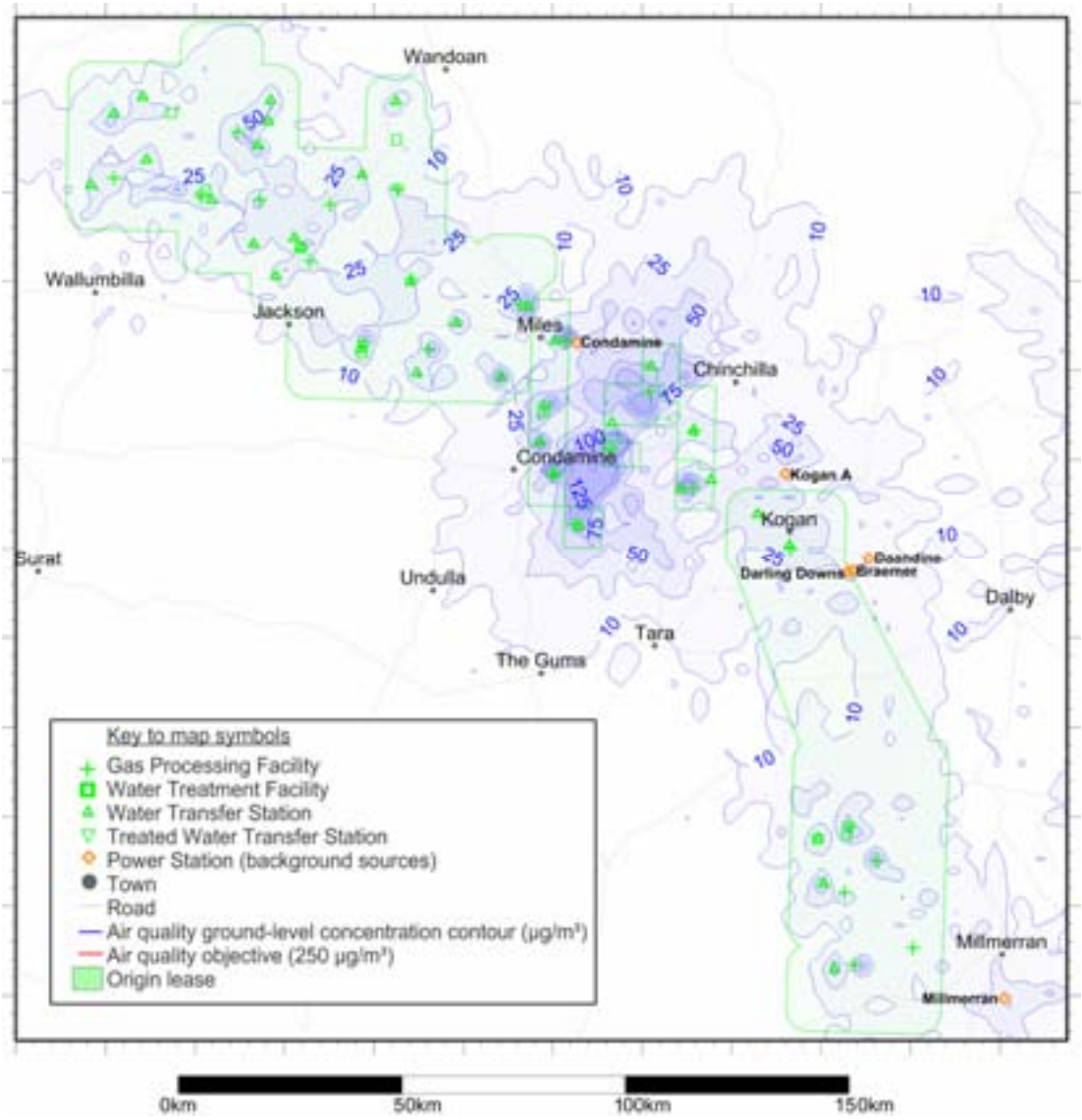

Figure 13.1 Predicted cumulative maximum 1-hour average ground level concentration of NO_2

13.5 Mitigation and management

Mitigation and management measures to meet the air quality objectives during construction of the gas fields include:

- Development of field or area specific construction environmental management measures under the environmental management plan to include measures to minimise emissions of dust, such as minimising area of unavoidable disturbance

- Design and operate facilities to meet the air quality objectives within EPP Air
- Ensure all vehicles and machinery are fitted with appropriate emission control equipment and maintained.

Mitigation and management measures to meet the air quality objectives during operation of the gas fields include:

- Implementation of preventative maintenance program to ensure equipment operates efficiently
- Use of micro-turbines at gas wellheads rather than gas-fired reciprocating engines wherever practicable
- Develop and implement a representative stack emission monitoring program for nitrogen dioxide in areas that are greater than 50% of the guideline.

13.6 Conclusion

13.6.1 Assessment outcomes

A summary of the environmental values, sustainability principles, potential impacts and mitigation measures in relation to air quality associated with the gas fields is presented below in Table 13.2.

A risk assessment has been undertaken to identify potential risks, causes and consequences from air emissions associated with the gas fields' activities. The risk assessment process is described in Volume 1 Chapter 4. Mitigation measures to reduce the risk have been nominated and the residual risk has been calculated. The residual risk level for air quality impacts is identified in Table 13.2.

Implementation of the proposed mitigation and management measures will ensure the air emissions associated with both the construction and operational phases of the Project will not result in a degradation of the ambient air quality at sensitive receptors, such that there is any risk of potential adverse health effects. Similarly, air emissions will not adversely impact terrestrial flora and fauna. Odour associated with project activities is unlikely to be evident at sensitive receptors.

By applying the above methodologies to air emission reduction and treatment technology, as well as managing dust generation, Australia Pacific LNG is able to undertake its activities in accord with its sustainability principles.

Table 13.2 Summary of environmental values, sustainability principles, potential impacts and mitigation measures

Environmental values	Sustainability principles	Potential impacts	Possible causes	Mitigation and management measures	Residual risk level
The qualities of the air environment that are conducive to: • protecting the health and biodiversity of ecosystems • human health and wellbeing • protecting the aesthetics of the environment • protecting agricultural use of the environment.	Minimising adverse environmental impacts and enhancing environmental benefits associated with Australia Pacific LNG's activities, products or services; conserving, protecting, and enhancing where the opportunity exists, the biodiversity values and water resources in its operational areas Identifying, assessing, managing, monitoring and reviewing risks to Australia Pacific LNG's workforce, its property, the environment and the communities affected by its activities	Community dust nuisance Heath impacts Impacts on agricultural production Flora and fauna impacts	Construction Dust from construction activities (e.g. earth moving, trenching, road building) Traffic on unsealed roads Wind-borne dust from disturbed land not rehabilitated.	Minimise area of unavoidable disturbance though project design Minimise duration of disturbance as far as practicable through project planning Implement dust suppression measures Rehabilitate areas as soon as reasonably practicable to restrict areas exposed to wind erosion	Low

Environmental values	Sustainability principles	Potential impacts	Possible causes	Mitigation and management measures	Residual risk level
As above	As above	Reduced air quality from pollutants Health impacts Flora impacts	Operations Combustion products from plant and equipment (wells, gas processing facilities, water treatment facilities, power generation, vehicles etc.) Venting and flaring of gas	Use lean-burn gas-fired engines (lower NO_x) wherever practicable Upgrade existing facilities to ensure air quality objectives within EPP Air are met (for example installation of non-selective catalytic converters to Talinga gas processing facility) Restrict venting of gas at wellhead facilities to emergency situations and periodic maintenance activities Minimise flaring at gas processing facilities (refer to Volume 2 Chapter 14 for discussion of greenhouse gas emissions) Design and operate facilities to meet the air quality objectives within EPP Air Use alternative low emission technologies as appropriate, including electric drive motors, where practicable	Negligible

13.6.2 Commitments

To manage the potential impacts of air emissions associated with the construction, operation and decommissioning of the gas fields and to meet air quality objectives, Australia Pacific LNG will:

- Conduct further investigations into technologies or options as part of development at Condabri and/or an expansion of the Talinga facilities and implement accordingly to meet air quality criteria
- Minimise dust emissions through the implementation of measures incorporated in environmental management plans that include, as far as practicable, minimising the area and duration of land disturbance activities, scheduling such activities to avoid adverse weather conditions, suppressing dust, and rehabilitating disturbed areas as soon as practicable
- Use lean-burn gas-fired engines (lower oxides of nitrogen) wherever practicable
- Develop and implement an air emission monitoring program for nitrogen dioxide, including installation of stack emission testing equipment in gas processing facilities
- Investigate alternative low emission technologies as appropriate, including electric drive motors.