Air Quality

6. AIR QUALITY

6.1. Introduction

6.1.1. Purpose

This Report summarises the existing legislative and physical air quality environment at the location of the Port Bonython Bulk Commodities Export Facility (BCEF), to provide context to an air quality impact assessment. The air quality impact assessment aims to investigate and quantify the likely impact of the Project on local and regional sensitive receivers, and to propose additional management and monitoring as required ensuring that air quality goals are achieved for the Project during construction and operation. **Chapter 15, Marine Ecology** addresses potential iron ore dust impacts on the marine environment.

6.1.2. Project Location

The Project is located approximately 1.5km west of the existing Santos Hydrocarbon Processing Plant at Port Bonython, 16.5km west-south-west of Whyalla, the nearest regional centre (refer **Figure 1.6ab** in **Chapter 1, Project Introduction**). This Figure illustrated the BCEF location in a local context, showing the nearest residences (located along the coastline, with the nearest being approximately 3km to the east-south-east). Nearby residences will have limited vision of the BCEF (refer to **Chapter 9, Visual Amenity**), with those to the east being obscured by the existing Santos facility and those to the north-east being shielded by the local topography. The air quality impact assessment study area included the immediate Project footprint plus the surrounding regional airshed, being the areas surrounding the Project footprint that have the potential to influence air quality at the BCEF.

6.2. Methodology and Assumptions

6.2.1. Methodology

The existing air quality has been assessed via a desktop review of available air quality information for the Port Bonython region, in addition to an Australia-wide review of applied air quality criteria. Baseline monitoring of the existing ambient air quality environment was not undertaken as it was considered that the existing air quality is essentially free of existing sources of pollutants. Current regional pollution sources are either located a sufficient distance away from the Project site (i.e. air emissions sources located in Whyalla) or are emitting pollutants in sufficiently small quantities as to be unlikely to result in a measurable decrease in the background air quality (i.e. the Santos Hydrocarbon Processing Plant).

The Project is proposed to utilise a fully-enclosed materials handling system which, when operating in accordance with the proposed design, will result in no release of fugitive particulate (dust) into the surrounding environment. For this reason, the methodology for the impact assessment is focussed on describing these dust management systems and providing context for their ability to achieve zero emissions via benchmarking and best-practice reviews of other, similar facilities and installations. Air quality modelling was not required to be undertaken as the Project proposes to release no material during normal operations.

The data gathered via benchmarking subsequently informed a risk assessment which was used to quantify the likelihood of the system operating as designed, the potential consequences for a system failure and to identify contingency measures that may be implemented should the system not operate as designed, or in the event of unplanned, emergency or abnormal events.

Impacts to health and amenity were determined by comparing both the proposed emissions from the Project, and emissions from other similar facilities and installations, to the nominated air quality criteria.

6.2.1.1. Particulate Overview

The Project has the potential to result in the emission of particulate matter (dust) which can have, in sufficient concentrations, impacts to health (e.g. decrease in lung function) and amenity (e.g. reduction in visibility) for residents in proximity to the proposed operation. In general, health impacts are aligned to the concentration of smaller dust particles, categorised at particles with a mean diameter of less than ten microns (PM_{10}) and particles with a mean diameter of less than 2.5microns ($PM_{2.5}$). Generally, the total amount of all sizes of dust (total suspended particulate, or TSP) in combination with the rate of dust deposition, or fall out, is used as a measure of the likely level of amenity impact, however an individual's perception of amenity is dictated by a number of more complicated factors so TSP concentrations and dust deposition should be used as a guide and little more.

6.2.1.2. Legislative Framework

A state-by-state review of air quality (particulate) criteria was undertaken, with analysis of each states air quality policies and guidelines used to determine "best practice" air quality criteria for the BCEF. In addition, operations at a number of high-profile bulk export facilities were reviewed with a view to determining whether project-specific air quality criteria were applied at these facilities via licencing or permitting arrangements.

6.2.1.3. Meteorology

Climate statistics were obtained from the meteorological station located at Whyalla Aerodrome (Bureau of Meteorology Station No. 018120) via the Bureau of Meteorology (BOM) website for the period July 1982 to September 2010, inclusive (Bureau of Meteorology, 2013b).

6.2.1.4. Existing Air Quality

Existing air quality was determined via a desktop review of local and regional particulate pollution sources, for which emission data was obtained through Annual Reports and National Pollutant Inventory (NPI) data, plus a review of prevailing meteorology in the context of the location of the identified pollution sources with regards to the BCEF. A review of local ambient air quality monitoring, via National Environment Protection (Ambient Air Quality) Measure (NEPM) reporting was also undertaken.

6.2.2. Assumptions and Technical Limitations

6.2.2.1. Meteorology

It has been assumed that the meteorology, particularly wind speeds and directions, recorded at the Whyalla Aero Bureau of Meteorology site (located approximately 22.5km west-south-west of the Facility) are similar to those conditions at Port Bonython, however, the coastal location and local topography of the Port Bonython site means that some variations are likely to be observed. The meteorological data are considered indicative of the conditions likely to occur at Port Bonython due to the proximity of the site to the meteorological monitoring station and the lack of significant geographical variation within the Project area.

6.2.2.2. Existing Air Quality

A review of the proposed Project configuration and associated construction and operational details has identified that, with the exception of the relatively minor emissions of greenhouse gases (refer **Chapter 12, Climate Change and Greenhouse Gases**), the emission of particulate is likely to be the only potentially significant air emission from the Project, and as a result, the Project will not negatively impact, or contribute to, existing concentrations of other pollutants that may or may not occur in the Port Bonython area. This assessment, therefore concentrates on the emission of particulates.

Particulate emissions from the Santos Hydrocarbon Processing Plant, the only local source of air pollution, have been obtained from the annual NPI database. It has been assumed that these emissions occur uniformly throughout the year, and are not the result of isolated, one-off, style emission events.

6.3. Policy Context and Legislative Framework

In Australia, particulate air quality is regulated by the States with over-arching guidance provided through that *National Environment Protection (Ambient Air Quality) Measure 2003* and associated amendments (collectively called the NEPM). Broadly, it is the responsibility of the relevant State jurisdiction (usually the local Environment Protection Authority) to manage air quality within individual airsheds in order to meet the goals of the NEPM, and this is achieved through the implementation of air quality policies, guidelines, legislation and individual facility licences. The legislative environment relevant to the BCEF is summarised in **Sections 6.3.1** and **6.3.2**.

6.3.1. Federal Legislative Environment

The NEPM sets ambient air quality criteria to be achieved in order to preserve health and safety values, and are based on Australian and International studies into the health effects of varying concentrations of pollutants on vulnerable members of the population, typically the elderly and small children. Strictly, these criteria apply to population centres of greater than 25,000 people and are to be monitored in such a way as to be representative of the average exposure of the population to pollutants within an airshed. The criteria are, therefore, not designed to be applied to peak sites or used for the regulation of individual operations. Monitoring and management of compliance with the NEPM criteria is the responsibility of the State jurisdiction, this being the Environmental Protection Authority (EPA) within South Australia. The NEPM criteria for particulates is summarised in *Table 6.3a*.

Table 6.3a: National Environment Protection (Ambient Air Quality) Measure 2003 particulate criteria (NEPC 2003)

Pollutant	Averaging Period	Maximum Concentration (µg/m³)	Maximum Allowable Exceedances
PM_{10}	24-hours	50	5
$PM_{2.5}$	24-hours	25	NA
	Annual	8	NA

6.3.2. Local and State Legislative Environment

Air emissions are regulated by the EPA via three mechanisms within South Australia, those being the requirement to meet the criteria established within the Air Quality Impact Assessment Guidelines (EPA, 2006), the requirement for point source emissions to comply with the *Environment Protection (Air Quality) Policy 1994 (EPA, 1994)* and any Project-specific licences or permits that may be administered.

6.3.2.1. Air Quality Impact Assessment Guidelines

The EPA "Air Quality Impact Assessment Using Design Ground Level Pollutant Concentrations" Guideline (2006) outlines ground-level pollutant concentrations that proposed facilities must demonstrate compliance with prior to Project approval. At the present time, these have no specific particulate concentration criteria.

6.3.2.2. Environment Protection (Air Quality) Policy

The *Environment Protection (Air Quality) Policy 1994* contains the following provision related to particulate emissions and relevant to the Project:

'Any process emitting solid particles (except a process using plant for the heating of metal or metal ores), the maximum concentration at the testing points determined in accordance with this Policy of solid particles in each cubic metre of residual gases after completion of the process but before admixture with air, smoke or other gases is a total mass of 250mg'.

6.3.2.3. Licence and Project-Specific Conditions

Licence conditions specific to the proposed Project will be developed following approval of the Environmental Impact Statement (EIS) and in cooperation with the EPA. Recent SA EPA Sustainability Licences and/or Development Authorisation approval conditions for major facilities (EPA 2010, SA Government, 2011) have generally specified that the NEPM particulate criteria be complied with as an operational contribution, i.e., excluding the influence of background particulate concentrations, which is consistent with the criteria generally applied at other, similar port facilities (refer **Section 6.3.3**).

6.3.3. Benchmarked Air Quality Criteria

A number of existing bulk commodities export ports operate within Australia. A review of a selection of significant facilities was undertaken with the aim of establishing whether further, more stringent, ambient air quality criteria had been assigned for these facilities. The results of this benchmarking are presented in **Table 6.3b**.

This review indicates that the application of the NEPM air quality standards as an operational contribution is the most commonly applied (and best-practice) criteria for bulk commodities export ports, with the addition, in some instances, of a TSP criterion for the maintenance of amenity values. The results of this review have formed the basis of the nominated air quality criteria for the Project (refer **Section 6.3.4).**

Table 6.3b: Benchmarking of Australian bulk commodities export port particulate criteria

Facility	Licence No.	Particulate-specific conditions/criteria	Reference
OneSteel Whyalla	13109	50 µg/m³ PM_{10} 24-hour average (operationally contributed)	EPA 2010
Esperance Port Authority	L5099/1974/13	50 µg/m³ PM_{10} 24-hour average (operationally contributed) 90 µg/m³ TSP 24-hour average (operationally contributed) 0.14 µg/m³ nickel-in-air 24-hour average 5 µg/m³ silica-in-air 24-hour average	DEC 2012a
BHP Billiton (BHPB) Port Hedland	L4513/1969/17	70 µg/m³ PM_{10} 24-hour average	DEC 2012b
Port Hedland Port Authority	L4432/1989/13	70 µg/m³ PM_{10} 24-hour average	DEC 2012c
Newcastle Port Corporation	13181	50 µg/m³ PM_{10} 24-hour average (operationally contributed) 30 µg/m³ $PM_1$0 annual average (operationally contributed)	NPC 2013
Townsville	EPP (Air) 2008	50 µg/m³ $PM_1$0 24-hour average (operationally contributed) 25 µg/m³ $PM_{2.5}$ 24-hour average (operationally contributed) 8 µg/m³ $PM_{2.5}$ annual average (operationally contributed)	EPA 2008
Darwin Port Corporation		No specific guidance (NEPM applied in Darwin)	
Geraldton Port Authority	L4275/1982/14	50 µg/m³ PM_{10} 24-hour average (operationally contributed) 90 µg/m³ TSP 24-hour average (operationally contributed) 0.5-2.0 µg/m³ Lead as PM_{10} 24-hour average (varies by location) 1.0 µg/m³ Copper as PM_{10} 24-hour average 50 µg/m³ Zinc as PM_{10} 24-hour average	DEC 2012d
Gladstone Port Corporation	EPP (Air) 2008	50 µg/m³ PM_{10} 24-hour average (operationally contributed) 25 µg/m³ $PM_{2.5}$ 24-hour average (operationally contributed) 8 µg/m³ $PM_{2.5}$ annual average (operationally contributed)	EPA 2008
Geelong (Point Henry)		No specific guidance (Compliance with the State Environment Protection Policy (Ambient Air Quality) required, criteria are the same as the NEPM).	EPA 2001
Bell Bay		No specific guidance (Environment Protection Policy (Air Quality) 2004 refers to compliance with the NEPM criteria)	DTAE 2004

6.3.4. Particulate Ground-Level Concentration Criteria

The legislative environment around air quality is described in detail in **Section 6.3** of this Chapter, together with a summary of the air quality criteria as applied at a range of similar facilities across Australia. SGPL has committed to best-practice air quality criteria for the Project, resulting in a commitment to the air quality criteria for construction and operation as described in Table 6.3c, where operationally-contributed is defined as the ground level dust concentration at the sensitive receiver minus the regional background dust concentration.

Table 6.3c: Nominated criteria for the Project

Pollutant	Averaging period	Maximum concentration (µg/m³)	Notes
TSP	24-hours	90	All concentrations represent operationally contributed dust
PM_{10}	24-hours	50	
$PM_{2.5}$	24-hours	25	
	Annual	8	

6.3.5. Air Quality Impact Assessment Significance Criteria

For the purpose of quantifying the likely impact and risk of the Project on air quality at the nearby sensitive receivers (refer **Section 6.4.4**), significance criteria has been developed to allow a ranking of impacts and risks in order of severity. This is presented in **Table 6.3d**.

Table 6.3d: Impact Significance Criteria: Air Quality

Impact significance / consequence	Description of significance
Very high	Regional, long-term and major predicted exceedance of the nominated air quality criteria. Without mitigation, regional and local residents will have their existing amenity significantly decreased, some may suffer negative health impacts and most will make formal complaints. Regulator intervention and state-wide media attention very likely.
High	Regional, short-term and major exceedance of the nominated air quality criteria. Without mitigation, regional and local residents will notice a short-term decrease in air quality/amenity and some may make a formal complaint. Some health complaints may arise. Regulator intervention likely, with possible negative media also.
Moderate	Local, long-term and minor exceedance of the nominated air quality criteria, OR regional, short-term and minor exceedance of the nominated air quality criteria OR local, short-term and major exceedance of the nominated air quality criteria. Without mitigation, local residents will notice a decrease in air quality/amenity and some will likely make a formal complaint, although impacts to health are unlikely. Some regional residents may notice a short-term decrease in air quality/amenity.
Minor	Local, short-term and minor exceedance of the nominated air quality criteria. Without mitigation, some local residents may notice a short-term minor decrease in air quality/amenity, although no impact to health is predicted.
Negligible	No, or insignificant, impact to existing air quality. Local residents unlikely to notice a change in local air quality/amenity.
Positive	An improvement in air quality at a local or regional scale

6.4. Existing Conditions

A summary of the existing air quality environment at Port Bonython is presented in the following sections, separated into natural (background) air quality and the influence of regional industrial emissions on air quality.

6.4.1. Meteorological Environment

A summary of local meteorology is presented in the following sections.

6.4.1.1. Climate Summary Statistics

Climate statistics relevant to air quality for Whyalla are presented in **Table 6.4a**. Plots of wind speed versus wind direction at 9am and 3pm are presented in **Figures 6.4a** and **6.4b**, respectively.

Table 6.4a: Climate Summary Statistics for Whyalla Aerodrome for the period 1982-2010 (BoM, 2013b)

Variable	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean maximum temperature (oC)	30.1	29.5	27.2	23.9	20.5	17.2	16.9	18.5	21.6	23.8	26.6	28.2	23.7
Mean minimum temperature (oC)	17.6	17.8	15.4	11.7	8.8	6.0	5.2	6.0	8.1	10.5	14.0	15.9	11.4
Mean rainfall (mm)	14.5	25.5	21.0	19.5	24.6	25.4	23.8	22.0	27.1	25	21.0	24.0	272.2
Mean no. of days with rainfall > 1mm	1.4	2.1	2.5	2.7	4.9	4.8	4.4	4.8	4.1	3.8	2.9	3.0	41.4
Mean 9am wind speed (km/h)	17.0	15.0	13.4	11.9	10.8	11.3	12.2	13.9	16.4	18.0	16.9	16.6	14.5
Mean 3pm wind speed (km/h)	24.6	23.3	21.2	19.6	17.6	17.6	19.2	21.3	22.4	24.3	23.7	24.2	21.6

Figure 6.4a: 9am wind rose for Whyalla (BoM, 2013b)

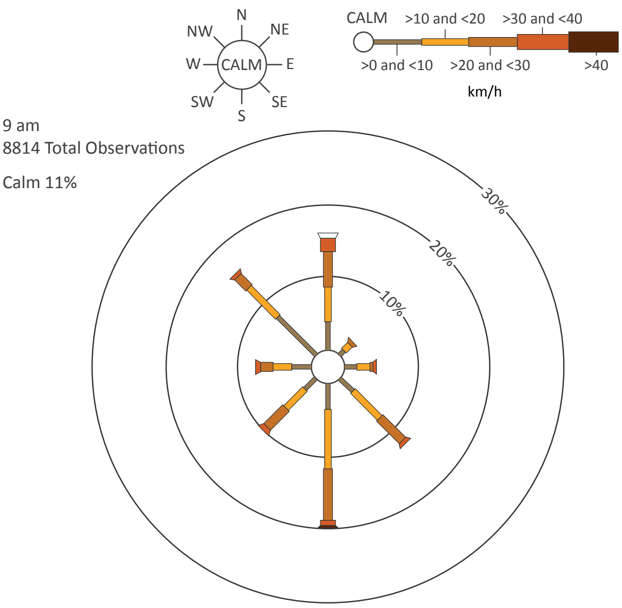
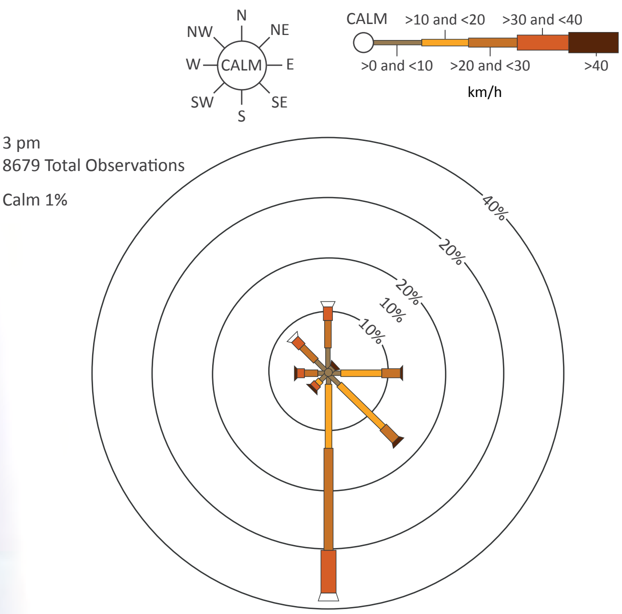


Figure 6.4b: 3pm wind rose for Whyalla (BoM, 2013b)



The wind speed and direction data indicate stronger winds in the afternoon, peaking during the summer months, with the prevailing wind direction being from the south, particularly in the afternoon as a sea breeze begins to dominate.

6.4.1.2. Dust Storm and Wind Erosion Events

All locations have a concentration of naturally-occurring background dust generated from wind erosion of the land mass inland. These concentrations are typically very low (approximately 5-10µg/m^3 for the $PM_{2.5}$ size fraction and approximately 10-20µg/m^3 for the PM_{10} size fraction, refer **Section 6.4.3** for further information). Isolated higher concentrations (up to 7,200µg/m^3 of TSP (less than 60µm) have been recorded for severe dust storms (CSIRO, 2011). The prevalence of dust storms in the Whyalla region has been estimated by the CSIRO with the results summarised in **Table 6.4b**, with the following definitions applying:

- *Severe* is defined as a visibility of less than 200m
- *Moderate* is defined as a visibility of less than 1000m
- Dust in the air defined as the number of days where the Total Suspended Particulate (particles less than 100µm) concentration exceeded 150µg/m^3/hour.

Table 6.4b: Estimated Annual Frequency of Wind Erosion Events (CSIRO, 1999)

	Wind erosion category (days per year)		
ABS Region	Severe	Moderate	Dust in the air
Whyalla	0.10	0.57	17.13

6.4.2. Local and Regional Pollutant Sources

An interrogation of the NPI database indicated six emissions sources for the Whyalla region (being the Arrium Whyalla steelworks, a Boral Resources quarry operation, two SA Water wastewater treatment plants, one hydrocarbon distribution facility within Whyalla in addition to one source in the Port Bonython locale, being the Santos facility (refer to **Figure 6.4c**). Particulate emissions data for the Santos Port Bonython Hydrocarbon Processing Plant is reported annually via the NPI, the results of which are presented in **Table 6.4c**.

Figure 6.4c: Local and regional sources of air pollution

Port Bonython EIS
Spencer Gulf Port Link

Figure 6.4c -
Local and regional sources of air pollution

Legend

Local and regional source of air pollution

ARUP

Spencer Gulf Port Link

1:75,000 (at A3)

0 1 2 4
Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: Geographic Datum of Australia
Grid: Map Grid of Australia 1994, Zone 53

Figure 6.4c: Local and regional sources of air pollution

Table 6.4c: Historical particulate emissions from the Santos Port Bonython Hydrocarbon Processing Plant (NPI, 2013)

	Particulate emissions (kg/year)	
Year	PM_{10}	$PM_{2.5}$
2010/2011	4,700	4,700
2009/2010	5,300	5,300
2008/2009	4,500	4,500
2007/2008	4,100	Not reported

Assuming the mass of particulate matter emitted from the Santos facility is released uniformly throughout the year and not as a result of isolated abnormal events, the 4,700kg of PM_{10} translates to an average emission rate of around 0.15 grams per second (g/s). The current gas flowrate for the Santos facility was not able to be determined, however even assuming a low flowrate of around 10,000 Normal cubic Metres per hour (Nm3/hr), the source concentration of particulate would be around 60mg/Nm3, well within the 250mg/Nm3 particulate limitation specified within the Environment Protection (Air Quality) Policy 1994 and therefore unlikely to significantly influence local air quality.

6.4.3. Existing Local Air Quality Monitoring

No publically-available ambient air quality monitoring data for the Port Bonython location exists. Ambient air quality monitoring is undertaken in Whyalla for the purpose of compliance with the requirements of the Ambient Air Quality NEPM and to provide for the regulation of emissions associated with the Arrium Whyalla steelworks. The SA EPA has determined, via the Sustainability Licence for Arrium Whyalla (EPA, 2012) that the ambient air quality monitoring site located at Schulz Reserve in Whyalla is representative of background air pollutant concentrations in the Whyalla region, being located approximately 5km west of the Arrium steelworks. It is considered that the monitoring data for this site will therefore be broadly representative of the ambient background air quality at Port Bonython. The results of the PM_{10} particulate monitoring for this site are presented in **Figure 6.4d** and summarised historically in **Table 6.4d**.

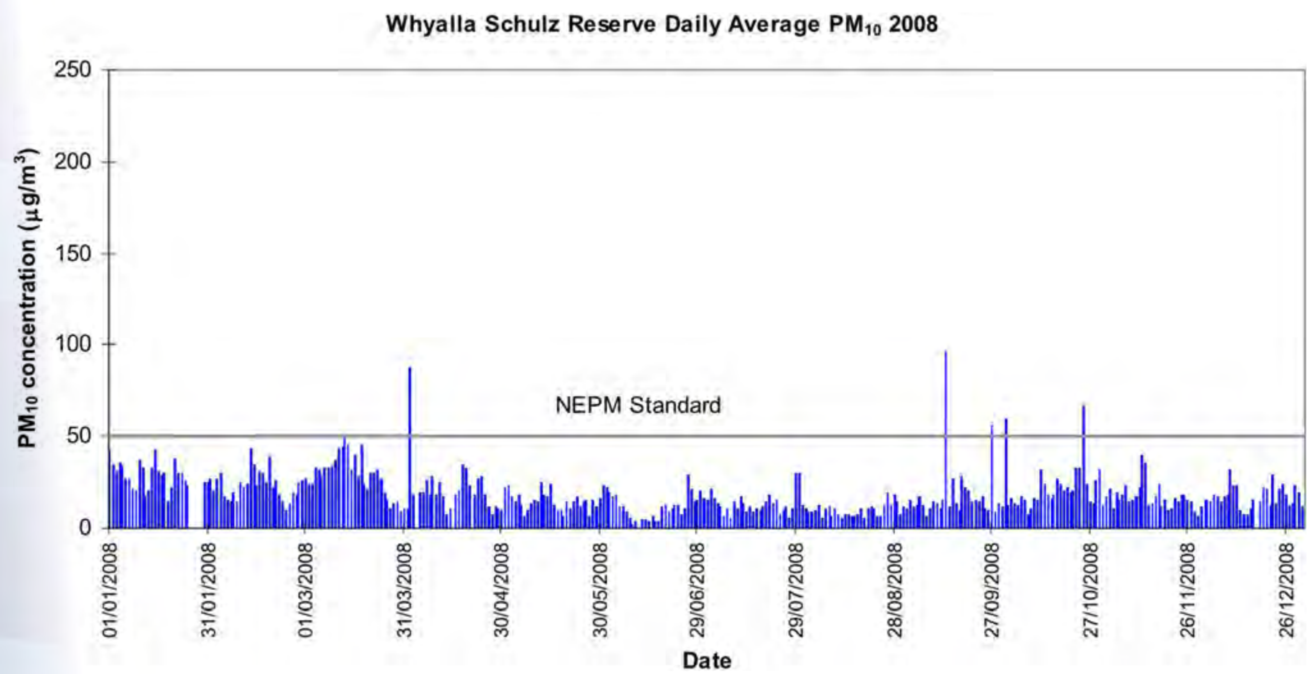
Up to five exceedances per year of the 50µg/m^3 criteria are permitted under the NEPM legislation

Table 6.4d: Background ambient air quality monitoring at Whyalla (EPA, 2012)

Year	Annual average PM_{10} (µg/m^3)	Maximum 24-hour average PM_{10} (µg/m^3)	No. of NEPM criteria exceedances
2008	19	97	6
2007	17	97	5
2006	17	54	2
2005	16	80	1

The results of the monitoring indicate low levels of ambient particulates at approximately 35-40 percent of the applicable ambient air quality criteria, and that levels generally comply with the five allowable exceedances per year.

Figure 6.4d: 24 hour average PM_{10} particulate concentrations at the Schulz Reserve air quality monitoring site in Whyalla (EPA, 2009a)



6.4.4. Sensitive Receivers

There are two primary groups of sensitive receivers, being terrestrial and marine ecology and human receivers. Terrestrial and marine ecology are discussed further in **Chapter 7, Terrestrial Ecology** and **Chapter 14, Marine Ecology** respectively. Human receivers are further broken down into those persons that may be impacted through working on the Project (i.e. occupational health and safety-related impacts, refer to **Chapter 17, Hazard and Risk**) and those residents of nearby communities that may be exposed to a reduction in air quality. The locations of the nearby residences have been reviewed and are detailed in **Figure 1.6a** in **Chapter 1, Project Introduction**, with the closest being some 1.6km from the Project. The nominated air quality criteria associated with emissions from the Project (refer to **Section 6.3.4**) must be met when measured (or modelled) at all nearby residences.

6.4.5. Summary of the Existing Air Quality Environment

Although there has been no specific ambient air monitoring at Port Bonython, there is evidence to suggest that the existing air quality is very good. Data from the EPA Whyalla background monitoring site suggests that PM_{10} concentrations are approximately 15-20µg/m^3 as an annual average, with approximately three or so exceedances of the 24-hour average NEPM criteria expected per year, both values being within the NEPM criteria. Dust storms are estimated to occur infrequently, with a moderate or severe storm expected only once every couple of years.

There are two potentially significant sources of regional air pollution, being the Arrium Whyalla steelworks and the Santos Port Bonython Hydrocarbon Processing Plant. The prevailing meteorology, together with the distance between the Arrium works and Port Bonython mean that emissions from this operation are unlikely to influence local air quality. The Santos facility, although local, emits little particulate matter (see Section 6.4.2) and is therefore also unlikely to have a significant influence on local air quality.

A review of port operation-specific air quality criteria was undertaken, the results of which indicate that the application of the NEPM particulate criteria, as an operational-contribution (i.e. excluding background sources) is the most common and stringent criteria adopted at similar facilities throughout Australia.

6.5. Potential Impacts

As a result of construction and operation of the BCEF, there exists the potential for the emission of particulates from activities associated with the Project, including land clearing and wind erosion during the construction stage and materials movements including the loading, unloading and transfer of ore during the operations stage.

The Project has committed to a number of pre-emptive management and mitigation measures for the protection of existing ambient air quality values for both the construction and operational stages. These are described in the following sections.

6.5.1. Construction

Land clearance, construction materials transport operations and potential on-site concrete batching operations represent the most significant potential sources of air emissions during the construction phase. **Section 6.3.1** outlines the management measures that will be applied to ensure the particulate criteria are met.

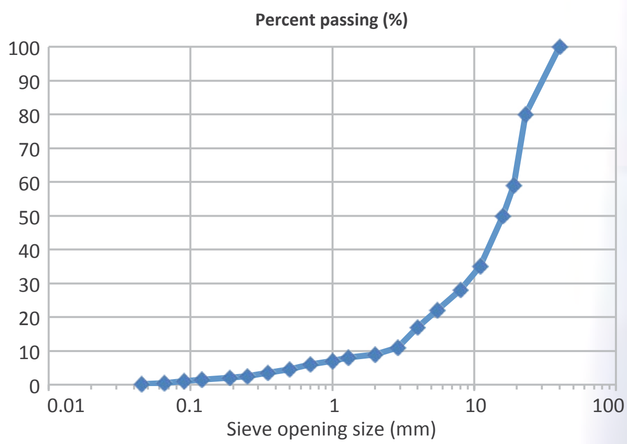
6.5.2. Operational Phase

The Project materials handling system is designed to convey 4000 tonnes per hour (TPH) of material movement and be fully-enclosed, eliminating the potential for fugitive particulate emissions during normal operations. A detailed description of how this will be achieved is provided in **Sections 6.5.2.1** to **6.5.2.4**.

6.5.2.1. Material properties

The Project materials handling system is designed to convey up to 4,000 TPH of iron ore. This material, occurring as a mix of lump, ore and fines, has a naturally low propensity to dust as a result of its generally large particle size, with an indicative silt content of only around 0.5-1%, its relatively high density (of around 3.5-4.5t/m3) and an in-situ moisture content of around 3%. Figure 6.5a provides an indicative particle sizing for iron ore lump proposed to be handled by the Project.

Figure 6.5a: Indicative iron ore lump particle size analysis



6.5.2.2. Rail Transport and Unloading

The rail wagons loaded with materials will be delivered to the Project rail dump facility, being an enclosed building with an opening for the train and the operators. The rail wagons will be of the bottom-dump variety, and will dump the iron ore into a hopper, the entirety of which is enclosed to trap fugitive dust, and fitted with reverse air filters capable of filtering approximately 130, 000m^3/h using approximately 765 filter envelopes. The contents of the hopper will be fed via an apron feeder to a transfer conveyor en route to the iron ore storage sheds. The apron feeder and transfer points will be fully enclosed, with dust collected from within these and the hopper facility fed back to the out-loading conveyor in order to minimise product losses. Water (fogging/misting) sprays will also be installed to provide additional dust suppression if required. Internal conveyors will not be enclosed, with emissions captured via the general building management system.

6.5.2.3. Iron Ore Storage Sheds

The iron ore storage sheds are fully enclosed with all openings sealed. During loading and unloading operations, the sheds are maintained under negative pressure to prevent the release of any fugitive emissions. This negative pressure will be achieved through the use of reverse air filters with a capacity of approximately 51,000m^3/h using approximately 350 filter envelopes. As with the rail dump facility, all transfer points will be fully enclosed and fitted with water sprays to provide additional dust suppression during out-loading operations, with captured dust returned to the out-loading conveyor, which will not be enclosed, with emissions captured via the general building management system.

A roller-type entry door will be fitted to each storage shed to provide access for a front-end loader. Dedicated transport routes and exclusion zones will be established within the shed to avoid wheel-travelled material being spread across the site by vehicles.

6.5.2.4. Materials Handling and Transport Infrastructure

All conveyors for the Project will be designed to minimise or eliminate fugitive dust emissions. This will be achieved through the full enclosure of all conveyors external to buildings. Specific routing of Project infrastructure will allow conveyor lines to be as direct as possible, reducing the number of transfer points required, with the remaining transfer points being fully enclosed and fitted with water (fogging/mist) sprays, where required.

Dust emissions from roadways and carpark areas will be managed through the application of a bitumen chip seal to the internal road network.

Although not a significant emissions source, all vehicles used during the construction and operation stages will comply with the relevant Australian Design Rules (ADRs) for vehicle emissions.

6.5.2.5. Ship Loading Infrastructure

Material from the storage sheds will be conveyed to the ship loading infrastructure via a fully-enclosed conveyor fitted with a shielded opening at the point of intersection with the ship loader. The luffing ship loader is capable of travelling approximately 220m up and down the wharf, and is designed to discharge approximately 1.5m inside the perimeter hatch of the vessel. A shuttling chute will be fitted to the ship loader to minimise drop distances.

All vessels using the BCEF will be required to meet relevant International and Australian standards and codes for the control of vessel air emissions.

6.6. Air Quality Impact Assessment

6.6.1. Benchmarking Review

There are a large number of existing bulk commodities export facilities operating within Australia. A selection of these was selected and benchmarked against the proposed BCEF infrastructure to confirm whether the proposed system is likely to be both adequate and effective. The results of this benchmarking are presented in **Table 6.6a.**

The review of other major bulk export port operations indicates that the use of fully-enclosed rail unloading, storage and conveyor systems fitted with dust extraction and suppression systems for the Project represents current best practice and will effectively mitigate fugitive particulate emissions. The benchmarking review has indicated that emissions during ship-loading activities have the potential to result in elevated dust levels, and also identified a variety of potential contingencies that can be implemented to manage these activities. This is discussed further in Section 6.6.3.

Table 6.6a: Benchmarking of Australian bulk commodities export port air quality management infrastructure

Facility	General description of port infrastructure and dust mitigation practices	Aerial photograph	Air quality performance
Esperance Port Authority	Infrastructure for handling bulk commodities at the Port of Esperance consists of fully-enclosed rotary rail car dumpers, a fully enclosed conveyor circuit and sheds that are maintained under negative pressure to eliminate fugitive emissions and fitted with dust extraction and filtration systems (Esperance Ports, 2013).		An extensive air quality monitoring system comprising eight monitoring sites using a combination of real-time dust concentration monitors, high volume samplers, e-samplers and dust deposition gauges. Six exceedences of the PM_{10} criteria were recorded in 2011/12, although it's noted that five of these were likely the result of unrelated grain loading activities (Esperance Ports, 2012).
Arrium Whyalla	The Whyalla port facilities consist of an enclosed shed for the storage of iron ore and enclosed conveyors and transfer points, all equipped with dust extraction and filtration systems. Arriving iron ore is treated with water to supress dust prior to unloading, and the rail unloading facility is fitted with a dust extraction system. The ship-loader is fitted with a dust shroud (curtain) and water sprays to contain fugitive dust. The dust control (monitoring) network allows real-time tracking of dust concentrations and determination of sources, allowing corrective/contingency actions to be implemented to specific areas of the plant as required (EPA, 2010)		The EPA operate a NEPM-standard PM_{10} dust monitoring station at Walls St in Whyalla, adjacent to the steelworks. This monitor recorded ten exceedances of the criteria for the year 2012 (EPA, 2013). The contributing factors to these events are not known and are more likely to be the result of non-port activities at the Arrium site.
Port Hedland Port Authority (PHPA)	The vast Port Hedland Port facility consists of open (uncovered) stockpiles, conveyors and ship-loading facilities. Dust impacts are mitigated through the application of water and dust suppressant chemicals to roadways, stockpiles and conveyors as necessary, by the use of dust baghouses and extraction systems on transfer points, by the control of moisture levels within the material and by the revegetation of disturbed land as soon as is practicable (PHPA, 2013).		An extensive real-time air quality monitoring system operates in the Port Hedland region. An analysis of air quality data from 2004-2010 indicated that background dust concentrations in Port Hedland average one exceedance of their 24-hour PM_{10} limitation (of $70 \mu g/m^3$) per annum (BHPB, 2011b).

Facility	General description of port infrastructure and dust mitigation practices	Aerial photograph	Air quality performance
Newcastle Port Corporation	The Port of Newcastle is the export port for the majority of the Hunter Valley coal operations, and consists of enclosed rail dump facilities and open coal stockpiles with stacker/reclaimer units. Generally, fully enclosed conveyor units are installed, except for adjacent to the ship-loaders for the Kooragang (northern) coal facility, the conveyors for which are open. Wind speed and direction monitors are installed at this facility and restrict loading and unloading operations when certain wind conditions exist (Newcastle Port Corporation, 2012).		Air quality monitoring data collected at the Mayfield Berth (located between the two coal terminals) indicates that of the 71 days sampled from April 2012 to May 2103, 15 days had PM_{10} particulate concentrations in excess of the criteria (Newcastle Ports Corporation, 2013). Note that these results may not be indicative of exposure within the nearby community.
Townsville	The majority of operations at the Port of Townsville consist of fully-enclosed rail unloading facilities, covered bulk commodities storages with material transferred via enclosed conveyors and transfer points to covered travelling ship-loading facilities. An open (uncovered) iron ore stockpile operates on the northern tip of the Port facility, using a combination of covered and uncovered conveyors to transport material to the ship-loader.		A combination of TEOM and high volume sampling is undertaken in and around the Port. Results from all monitors indicated no exceedance of criteria in 2011-12 (Port of Townsville, 2012).
Darwin Port Corporation (East Arm Wharf)	The East Arm Wharf has been designed for the export of bulk commodities, and is currently being upgraded in accordance with its approved EIS. Currently has a mixture of covered (transit) and uncovered stockpiles with enclosed stockpile reclaim conveyors and ship-loader (Darwin Port Corporation, 2013).		High-volume sampling undertaken near-source. No non-compliances with regulatory requirements were recorded in 2011-12 (Darwin Port Corporation, 2012).
Geraldton Port Authority (GPA)	All materials storages are enclosed within sheds fitted with dust extraction equipment which is operated whenever material movements are undertaken (EPA, 2013). All conveyors and transfer points are also enclosed. In addition, moisture levels of the material are maintained and managed by the owner of the material to reduce dust, foaming agents are added to the conveyor system to further reduce dust, and wind speed and direction monitoring occurs in order to reduce potential for dust generated during ship-loading to travel towards the community (GPA, 2013).		Dust (and lead) levels are generally very low (GPA, 2013), however it was identified that during ship loading, dust concentrations increase and have the potential to exceed criteria within the community (Department of Health, 2011). The addition of restrictions to ship-loading operations during particular wind scenarios was to mitigate this risk.

Facility	General description of port infrastructure and dust mitigation practices	Aerial photograph	Air quality performance
Gladstone Port Corporation (GPCL)	This facility exports bulk coal and minerals via open (uncovered) stockpiles and generally uncovered conveyors (transfer points are enclosed) to mobile ship-loaders which are fitted with dust extraction equipment. Gantry-mounted misting sprays to control dusting at the coal terminal are fitted at some points along the materials handling path (GPCL, 2013a), and a programme exists for the continued roll-out of these. Other mitigation, in the form of water sprays on stockpiles, establishment of wind breaks, and use of water carts on roadways are also used as required (GPCL, 2013b)		47 exceedances of the particulate limits were recorded by the on-site dust monitors in 2011-12, of which 19 were attributable to operations at the Port. GPCL state that no exceedences of the particulate limits at their nearest community dust monitoring stations occurred in 2011-12 (GPCL, 2013a).
Geelong (Point Henry)	Alcoa imports materials to the Point Henry Refinery via a dedicated port facility. Materials are transferred from the ships via a grab (although a vacuum suction arm is available, this is restricted in throughput (Geelong Port, 2013) onto a covered conveyor, with materials transferred into covered tanks for use in the refinery processes (Alcoa, 2013).		Alcoa reported no exceedences of air emissions criteria in 2011 and the first half of 2012, being their most recent Environmental Improvement Plan status update (Alcoa 2012a & 2012b).
Bell Bay	The Bell Bay Aluminium (Pacific Aluminium) bulk commodities handling facility features stockpiles enclosed in sheds, with covered conveyors and transfer points transferring materials to a travelling ship-loader. The greater Bell Bay Bulk Export Facility features generally open (uncovered) stockpiles, with materials transferred via covered conveyors to a single fixed (non-mobile) ship-loader.		Bell Bay Aluminium reported two exceedances of their point-source (dust collector) emissions in 2012 (Bell Bay Aluminium, 2013) however the reasons for these were not stated. Online monitors have been installed to monitor the future performance of the dust collectors. No community complaints were received in 2012.

6.6.2. Estimation of particulate emissions

The likely volume of dust emitted for unit operations associated with the Project, given the applied mitigation, was estimated using National Pollutant Inventory (NPI) Emission Estimation Technique Manuals, the results summarised in Table 6.6b.

The average rate of particulate emission for the Project during normal operations, calculated using the NPI emission estimation techniques, is 0.07 g/s. This level of dust generation is virtually negligible and would not be expected to result in any change to existing air quality at the nearest sensitive receivers.

6.6.3. Assessment of Impact Significance

During construction, there is the potential for the emission of particulate material during land clearing, construction materials movement and on-site concrete batching works. Unmitigated, these have the potential to result in the short-term exceedance of the nominated criteria, representing a minor significance rating.

A review of the performance of other, similar facilities, together with an estimation of total dust generation associated with the Project given the applied mitigation, has indicated that during normal operations, provided the installed management measures are maintained and operated appropriately, the proposed air quality management system will be sufficient to effectively mitigate fugitive emissions, preserving the existing ambient air quality at the nearest sensitive receivers. This, therefore, represents a likely impact significance rating for the Project of negligible.

Table 6.6b: Estimated particulate emissions for the Project

Emission source	Mitigation	Emission factor	Emission rate
Rail unloading	Full enclosure with ventilation filtration	100% mitigation (NPI EET for Mining, Table 4)	0
Stockpiling	Full enclosure with ventilation filtration	100% mitigation (NPI EET for Mining, Table 4)	0
Materials handling	Full enclosure of conveyors and transfer points	0.002 kg/t (NPI EET for Mining, Table 3) plus 99% reduction to account for applied mitigation (NPI EET for Mining, Table 4)	0.02 g/s
Ship loading	Fogging sprays and telescopic chute	0.00017kg/t (NPI EET for Mining, Appendix A 1.1.15) plus 75% reduction to account for applied mitigation (NPI EET for Mining, Table 4)	0.05 g/s

6.6.4. Mitigation Measures and Monitoring

6.6.4.1. Construction Stage

There exists the potential for the generation of dust emissions during the construction phase. In order to manage the risks associated with this, the following mitigation measures are proposed:

- Stage clearing activities to minimise the areas of exposed earth
- Cover access tracks with crushed rock or other material in required areas to reduce mud collection on vehicle wheels and dust generation from crushed dirt once the mud dries
- Implement low speed limits on haul roads/access tracks to reduce vehicle dust
- Control dust emissions via use of a water cart, an appropriate dust suppression agent (chemical) and/or localised water spraying (particularly on concrete batching stockpiles)
- Manage/reschedule construction works during periods of high winds and high evaporation rates by reviewing daily weather forecasts
- Cover vehicle loads while transporting loose, dry or dusty material
- Install rumble grids or stabilised entry ways at all entry points to bitumen roads to
- remove any residual material on wheels to prevent dirt being tracked onto roads
- Deploy street sweeping in the event that mud or soil build up is detected at intersections with bitumen roads
- Install dust screens and/or wind fences to shield exposed areas where appropriate and necessary
- Revegetate unused disturbed areas as soon as practicable
- Soil stockpiles will be situated away from sensitive receptors and will be seeded or otherwise covered as required
- Burning of vegetation or materials onsite will be prohibited.

In order to ensure that the above-mentioned measures are being implemented appropriately, all dust-generating activities will be inspected daily.

6.6.4.2. Operations Stage

No additional mitigation beyond that proposed is deemed to be necessary, however a number of contingency measures are available to ensure that dust concentrations do not exceed the nominated criteria, even under emergency, unplanned or abnormal operations. For the conveyors, transfer points and stockpiles, these may include actions such as:

- The manual application of water or foaming agents to stockpiles and/or conveyors to reduce dust levels
- The cessation of dust-generating operations until such time as the equipment is operating satisfactorily
- The use of redundant / back-up dust extraction systems.

For the rail unloading activities, these may include actions such as:

- Application of water or foaming agents to rail carts to maintain material moisture levels
- The manual application of water within the unloading facility during unloading
- The cessation of dust-generating operations until such time as the equipment is operating satisfactorily
- The use of redundant / back-up dust extraction systems.

For the ship-loading operations, these may include actions such as:

- Application of water or foaming agents to conveyors prior to the ship-loader to maintain material moisture levels
- The use of misting sprays fitted to the ship-loader during loading operation
- The use of wind speed/direction instrumentation to set operational limitations on ship-loading activities (e.g. no loading when the wind is blowing on-shore above a certain speed).

A Management and Monitoring Plan will be developed (refer **Chapter 19, Environmental Management Plan**), outlining roles and responsibilities, training requirements, reporting requirements, and the process and triggers for implementing the above-mentioned contingency measures. The Plan will also describe the monitoring required to determine the effectiveness of the installed systems, which may consist of:

- Audible and/or control system alarms to alert people to a potential failure of any dust extraction, dust cleaning (baghouses and/or water sprays) and/or negative pressure systems
- A preventative maintenance regime designed to ensure that installed system operate in accordance with manufacturers specifications
- Real-time PM_{10} dust monitoring stations at locations to be determined in accordance with Australian Standards, to monitor the outcomes of the management system until such time as confidence in the performance of the system has been established and to allow for the implementation and/or application of reactive mitigation when the criteria is exceeded
- A compliant reporting mechanism for sensitive receptors (coastal homes of Point Lowly and False Bay) to the BCEF.

It is likely that any unplanned, abnormal or emergency equipment failure-related dust event will be short-term in nature, representing a minor risk to nearby sensitive receivers. With the application of the appropriate contingency measures, the duration of any exceedance will be minimised.

6.7. Conclusion

The proposed Project air quality management infrastructure has been reviewed and benchmarked against other, similar, facilities and has been determined to represent current best practice in terms of air emission mitigation. A summary of the impacts and risks are provided in **Table 6.7a**.

Table 6.7a: Residual Impact and Risk Significance Summary

Activity Consequence	Significance	Likelihood	Applied Mitigation	Residual Rating	Description And Justification of Significance
Construction impact	Minor	Unlikely	Contingency measures implemented as per **Section 6.6.3.1**	Low	There are sufficient contingency measures available to effectively mitigate dust emissions during construction. Local residents are unlikely to notice a change in local air quality/amenity.
Operational impact (normal operation)	Negligible	Unlikely	None required	Low	Installed dust management / mitigation measures represent best practice and have been shown to be effective at managing dust at other bulk export port facilities. Local residents are unlikely to notice a change in local air quality/amenity.
Operational risk (abnormal, unplanned or emergency situations)	Minor	Possible	Contingency measures implemented as per **Section 6.6.3.2**	Medium	There are sufficient contingency measures available to effectively manage a failure or underperformance of the installed dust management system, however such an event may result in a local, short-term and minor exceedance of the nominated air quality criteria whilst the contingency is being implemented. Without prompt mitigation, some local residents may notice a short-term minor decrease in air quality/amenity, although no impact to health is predicted.