CHAPTER 10
AIR QUALITY

10 Air Quality 10-1

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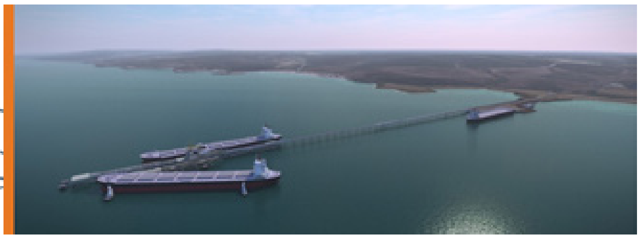

10 Air Quality

The proposed CEIP Infrastructure could introduce new air emission sources to the project area as a result of the transport of iron concentrate along the infrastructure corridor and materials handling and ship-loading activities at the proposed port site.

This chapter describes how the introduction of these emission sources would affect ambient air quality and public amenity values. It provides a comparison of the predicted particulate concentrations and dust deposition levels to regulatory limits (where available) or advisory standards at sensitive receiver locations based on project design and management measures. Risks associated with project-related emissions that could reasonably occur during construction and operation of the CEIP Infrastructure are also considered.

Appendix J presents further details in the CEIP Infrastructure Air Quality Impact Assessment Report.

The potential effects of air emissions from the project on terrestrial flora and fauna and the marine environment are addressed in Chapters 13 and 14 respectively.

10.1 Applicable Legislation and Standards

Air quality indicators and ambient air quality criteria are specified in the EPA guidance document, *EPA 386/06, Air quality impact assessment using design ground level pollutant concentrations (DGLCs)*, updated January 2006 (EPA 2006). These criteria were used for the assessment of gaseous emissions from the locomotives proposed to be used as part of the railway operation.

While EPA (2006) does not provide air quality criteria for particulate matter, there is a requirement to source appropriate alternatives. The National Environment Protection (Ambient Air Quality) Measure (NEPM) standards and guidelines for particulate matter 10 µm or less in diameter (PM_{10}) and for particulate matter 2.5 µm or less in diameter ($PM_{2.5}$) were adopted for the project (NEPC 2003). The NSW Department of Environment and Conservation (DEC) standards and guidelines for Total Suspended Particulates (TSP) and deposited dust were adopted for the project by the EPA for the protection of amenity from nuisance dust (DEC 2005).

The ambient air quality standards adopted for the project are set out in Table 10-1 (EPA 2006), Table 10-2 (NEPC 2003) and Table 10-3 (DEC 2005).

Table 10-1 Adopted Project Criteria for Gaseous Emissions from Locomotives (EPA 2006)

Assessment Parameter	Averaging Period	Maximum, Including Background	Notes
Nitrogen dioxide (NO_2)	1 hour	0.158 mg/m^3	Outside Adelaide metropolitan area, based on toxicity
Sulphur dioxide (SO_2)	1 hour	0.45 mg/m^3	Based on toxicity
Carbon Monoxide (CO)	1 hour	29 mg/m^3	Based on toxicity

Table 10-2 Adopted Project Criteria for the Protection of Human Health from Airborne Particles (NEPC 2003)

Assessment Parameter	Averaging Period	Maximum, Including Background	Goal (Maximum Allowable Exceedances)
PM10	24 hours	50 $\mu g/m^3$ (NEPM)	5 days a year
PM2.5	24 hours	25 $\mu g/m^3$ (NEPM)	Not specified*
PM2.5	Annual	8 $\mu g/m^3$ (NEPM)	Not specified*

* There is currently no specified goal in NEPC 2003 for maximum allowable exceedances for $PM_{2.5}$, however there is a goal specified to gather sufficient data nationally to facilitate a review of the Advisory Reporting Standards as part of the review of this Measure.

Table 10-3 Adopted Project Criteria for Nuisance Dust (DEC 2005)

Assessment Parameter	Averaging Period	Maximum, Including Background Level	Notes
TSP	Annual	90 $\mu g/m^3$	-
Dust deposition	Annual	4 g/m^2/month	Maximum total deposited dust level

10.2 Assessment Method

Air quality assessments were undertaken for the CEIP Infrastructure components which included:

- Air quality modelling of dust emissions and qualitative assessment of gaseous emissions (e.g. emissions from diesel engine powered equipment) associated with the proposed port operation.
- Air quality modelling of locomotive combustion emissions at a single indicative location along the proposed infrastructure corridor and qualitative assessment of dust emissions from the proposed infrastructure corridor.
- Qualitative assessment of the potential air emissions from construction works.

For a detailed description of the air quality impact assessment methodology, refer to the CEIP Infrastructure Air Quality Impact Assessment Report presented in Appendix J.

The assessments incorporated the following tasks:

- Identification of potential air emissions from the CEIP Infrastructure
- Determination of relevant air quality standards and criteria
- Identification of sensitive receivers
- Establishment of existing air quality conditions in the project locality
- Prediction of meteorological conditions using the TAPM and CALMET computer models (where applicable)
- Prediction of ground level concentrations of air emissions from the project using the CALPUFF computer dispersion model (where applicable)
- Comparison of the predicted emission levels with relevant air quality criteria
- Modification of design or development of management measures to reduce the predicted levels to below the relevant criteria if necessary.

Air emission sources associated with this project were identified and estimated for the proposed port site based on techniques set out in the National Pollutant Inventory (NPI) *Emission Estimation Technique Manual (EETM) for Mining* Version 3.1 (DSEWPaC 2012a).

10.3 Existing Environment

This section discusses the existing air quality conditions and location of sensitive receivers within the project locality. Background air pollution estimates were included in the modelling to provide a thorough assessment of cumulative impacts.

10.3.1 Existing Background Air Quality

The existing air quality in the project area is expected to be very good or good (as defined by the EPA in the SA Air Quality Index) due to the rural location with low levels of road traffic and limited industrial activity. The existing air pollution is expected to be airborne particulate matter including wind-blown aerosols and dust, vehicle/machinery generated dust from un-paved roads and ground disturbance in paddocks, other agricultural activities and fires, such as shown in Plate 10-1, Plate 10-2 and Plate 10-3.

Plate 10-1 Example of Machinery-Generated Dust on Eyre Peninsula

The EPA provided background particulate levels to be used in the air quality modelling based on monitoring data for two sites:

- Schultz Park, Whyalla for PM_{10} particulate concentrations
- Netley, Adelaide for $PM_{2.5}$ particulate concentrations.

No data is available for total suspended particulates (TSP) at the two monitoring sites. Typically, for rural areas, TSP is approximately twice the concentration of PM_{10} based on the PM_{10} and TSP emission factors outlined in the NPI EETM for Mining (DSEWPaC 2012a).

The background concentration levels adopted for the air quality assessment are presented in Table 10-4.

Table 10-4 Background Concentration Levels Used in the Air Quality Assessment

Parameter	Value
Background maximum 24-hour average PM_{10} concentration selected for input to modelling study.	22 µg/m^3
Background maximum 24-hour average $PM_{2.5}$ concentration selected for input to modelling study.	10 µg/m^3
Background annual average $PM_{2.5}$ concentration selected for input to modelling study.	7 µg/m^3
Background annual average TSP concentration determined for modelling study (all seasons).	30 µg/m^3
Background monthly dust deposition determined for modelling study (all seasons).	2 g/m^2/month

Plate 10-2 Vehicle-Generated Dust on Kimba Road

Plate 10-3 Truck-Generated Dust on Sealed Road

10.3.2 Sensitive Receivers

Sensitive receivers include locations where people live or work that may be affected by air quality impacts due to the proposed development of the CEIP Infrastructure. This includes dwellings, schools, hospitals, business premises or public recreational areas. Environmental receivers such as terrestrial flora and fauna and the marine environment are addressed in Chapters 13 and 14 respectively.

The sensitive receivers closest to the proposed development are individual dwellings on agricultural properties located intermittently around the proposed port development, along the infrastructure corridor and at Wudinna (near the proposed long-term employee village) as well as a number of small towns including Port Neill, Rudall and Verran. There are also two grain storage and handling facilities in the vicinity of the proposed infrastructure corridor – one near Port Neill and one at Taragoro (half way between Verran and Rudall).

The closest sensitive receivers to the proposed port development are illustrated in Figure 10-1.

The closest identified sensitive receiver to the port site is a dwelling located on land owned by the District Council of Tumby Bay, adjacent to the boundary of port land owned by Iron Road, on the south-east side. The sensitive receivers in the vicinity of the proposed port development are residential dwellings, the Port Neill township and the Port Neill grain silos (refer to sensitive receiver 229 on Figure 10-1).

There are approximately 30 dwellings, the Driver River Uniting Church (Verran) and the Taragoro grain storage and handling facility within 1 km of the proposed infrastructure components along the infrastructure corridor (including the borefield wells, water pipeline, railway line and power transmission line). Table 10-5 lists these sensitive receivers and the estimated distances to each component of infrastructure (also refer to Chapter 12, the noise assessment, for additional information on the location of sensitive receivers along the proposed railway line including a map illustrating locations).

Table 10-5 Sensitive Receivers within 1 km of Infrastructure Components

Sensitive Receiver ID*	Site Use	Distance to Railway Line (m)	Distance to Borefield Infrastructure (m)	Distance to Water Pipeline (m)	Distance to Transmission Power Line (m)	Distance to Boundary of Port Land Owned by Iron Road (m)
1	Dwelling	478	23,819	457	415	92,894
3	Dwelling (possibly uninhabitable)	1,038	20,987	1,016	974	89,901
6	Dwelling	357	14,050	335	293	83,103
8	Dwelling (possibly uninhabitable)	170	17,366	148	106	86,343
10	Dwelling	1,966	799	1,989	2,030	69,585
12	Dwelling (possibly uninhabitable)	233	696	1,376	172	66,576
13	Dwelling	965	12,082	13,152	1,276	55,873
16	Dwelling	466	15,396	16,371	3,889	52,451
17	Dwelling	421	18,278	19,395	3,974	50,774
18	Dwelling	749	19,464	20,499	5,715	49,114
20	Dwelling	1,003	24,290	25,290	9,137	44,582
23	Dwelling	440	29,691	30,716	12,875	40,258
26	Dwelling	197	35,098	36,026	18,633	34,402

Sensitive Receiver ID*	Site Use	Distance to Railway Line (m)	Distance to Borefield Infrastructure (m)	Distance to Water Pipeline (m)	Distance to Transmission Power Line (m)	Distance to Boundary of Port Land Owned by Iron Road (m)
27	Driver River Uniting Church at Verran	141	34,769	35,702	18,299	34,743
29	Dwelling	655	44,841	45,629	29,035	23,905
34	Dwelling (possibly uninhabitable)	188	53,043	53,711	38,138	14,838
35	Dwelling	884	54,086	54,691	39,959	13,224
40	Dwelling	915	64,242	64,849	49,356	3,464
42	Dwelling	450	65,618	66,191	51,160	1,762
43	Dwelling	288	66,335	66,921	51,627	1,208
44	Dwelling	1,701	70,635	71,159	56,607	70
67	Dwelling	964	15,790	986	1,028	84,941
68	Dwelling	922	14,692	945	986	83,862
69	Dwelling	317	12,921	338	380	82,028
71	Dwelling	285	42,490	43,297	26,698	26,284
81	Dwelling	3,200	12,737	13,990	401	56,379
82	Dwelling	5,056	19,683	21,032	698	52,560
83	Dwelling	11,309	747	11,331	11,372	69,441
84	Dwelling	4,618	957	4,639	4,680	66,377
86	Dwelling	6,653	782	6,675	6,716	69,089
91	Dwelling	1,363	587	1,454	1,302	67,740
226	Taragoro grain storage and handling facility	310	25,669	26,735	9,184	44,099

* Note:

- The locations of sensitive receivers have been primarily determined by desktop assessment of aerial imagery and are subject to field and community verification.
- The sensitive receiver IDs are not sequential due to progressive development of the database over time.
- The same sensitive receiver IDs are used for the same sites throughout the EIS.

Figure 10-1 Sensitive Receivers in the Vicinity of the Proposed Port Development

10.3.3 Summary of Key Environmental Values

The various components of the proposed CEIP Infrastructure are all located in areas where the existing air quality is expected to be very good or good (as defined by the EPA in the SA Air Quality Index) due to the rural locations, with low levels of road traffic and limited industrial activity. Subsequently the good air quality experienced by the sensitive receivers and local communities is considered a key environmental value. Good air quality is highly valued by community members as it relates directly to maintaining community health and safety (e.g. visibility).

10.4 Design Measures to Protect Environmental Values

The design of the various CEIP Infrastructure components has incorporated several measures to minimise potential air quality impacts. These are summarised below.

10.4.1 Proposed Infrastructure Corridor

The design of the proposed railway line and operation includes the following measures to minimise potential air quality impacts:

Proposed Railway Line

- The loaded rail wagons are proposed to be covered prior to leaving the proposed mine to prevent loss of the iron concentrate.
- New locomotives will be used which will meet the Australian Standards for railway rolling stock and emit less diesel fumes than older locomotives.

10.4.2 Proposed Port Development

The design of the proposed port development includes the following measures to minimise potential air quality impacts:

Rail Unloading Facility

- The rail unloading facility will be enclosed to assist with maintaining the moisture content of the iron concentrate (approximately 10%) and fitted with a dust control system under the wagons, at the bottom dumper tip point and conveyor loading point, to capture any residual dust generated during unloading.
- An automatic wagon vibrator will detect if iron concentrate is hanging on to the side of a wagon and use a mechanical arm to vibrate the affected wagon to ensure the contents are emptied completely before leaving the enclosed facility.

Port Site Concentrate Stockpile

- The iron concentrate will have a relatively high moisture content of approximately 10% which will reduce the potential for dust generation and regular monitoring of moisture content will ensure the iron concentrate remains within strict moisture content parameters for safe shipping.
- The concentrate stockpile boom stacker and bucket-wheel reclaimer will be fitted with dust suppression sprays to control any dust that may be generated during stacking and reclaiming of the stockpile.
- Application of water onto the stockpile by spray cannons mounted on water trucks will be undertaken as required to maintain the moisture content of the stockpile.
- An organic veneering agent will be added to the water sprayed by the water trucks to bind and stiffen the surface of the stockpile to create a cohesive layer over the surface of the concentrate and reduce the emission of wind generated dust.

Conveyors and Transfer Stations

- The conveyor systems will be fully covered.
- The two transfer stations will be fully enclosed around the conveyor transfer chutes where the iron concentrate will be transferred from one conveyor to the next, and will be fitted with a dust control units to capture any residual dust.
- One transfer station will be fitted with water sprays to increase moisture content should this be required to meet product specifications for safe shipping.

Ship Loader

The ship loader design includes an extendable/retractable telescopic chute which will be extended into the ship's loading hatch and rise as the vessel hold fills to maintain a short separation distance between the iron concentrate in the hold and the concentrate leaving the chute to minimise dust emitted during loading. Refer to Figure 10-2.

Figure 10-2 Ship Loading Operation

A simplified schematic of the materials handling process is shown in Figure 10-3.

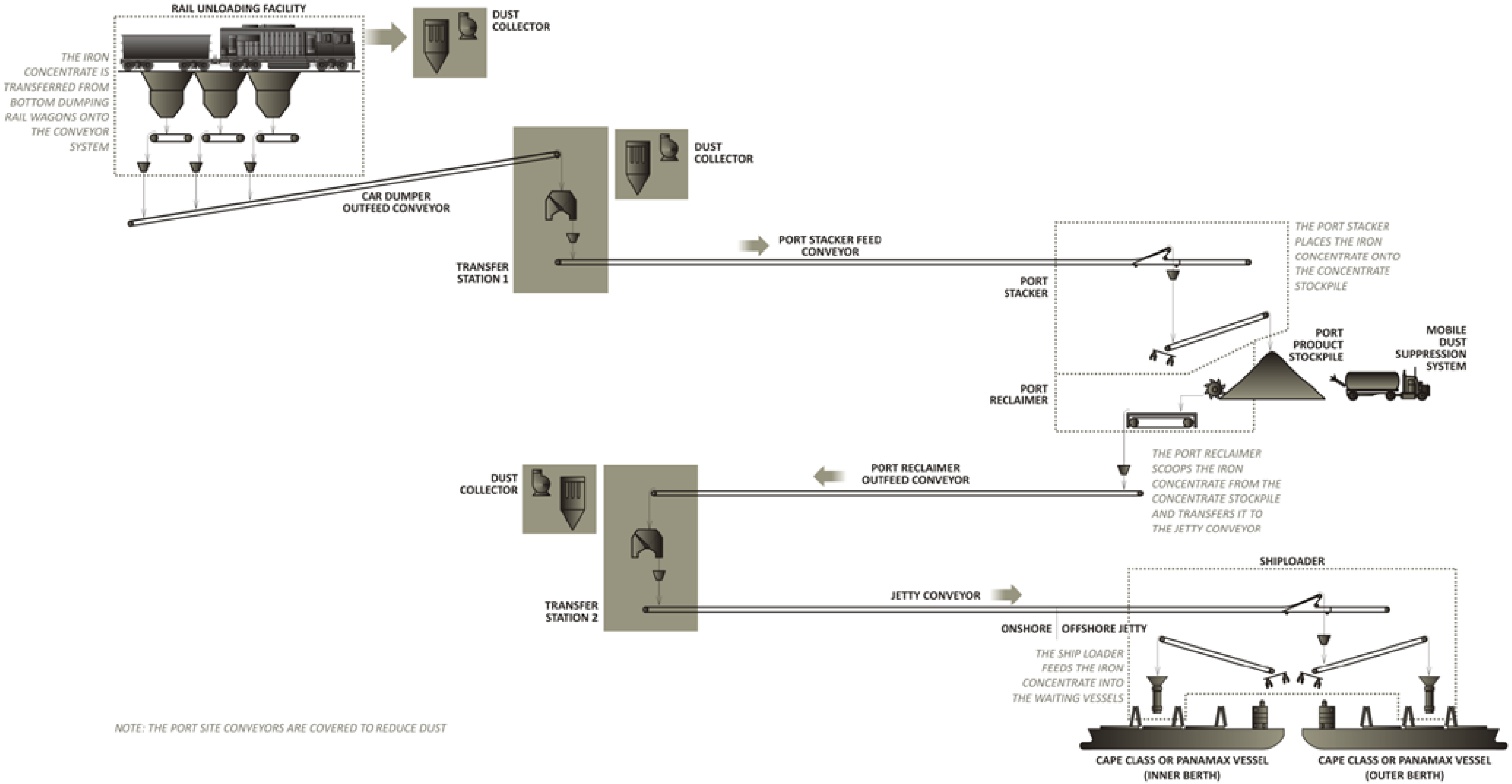

Figure 10-3 Port Site Simplified Process Flow Diagram Showing Materials Handling

10.5 Impact Assessment

This section assesses air quality impacts on surrounding sensitive receivers that are likely to result from the construction and operation of the proposed CEIP Infrastructure.

Impacts have been assessed in accordance with the impact assessment methodology outlined in Section 10.2 and Chapter 9. A summary table of these impacts is provided in Section 10.5.5.

10.5.1 Sources of Air Emissions

Air emissions associated with the proposed CEIP Infrastructure may result from construction activities, rail transport of the iron concentrate and operations at the port. The sources of emissions for each project component and emission estimates for significant sources are summarised below.

Air Emissions from Construction

During construction, sources of air emissions are likely to include:

- Wind-borne dust from exposed surfaces, such as cleared areas, temporary stockpiles and excavations
- Materials handling activities associated with earthworks requirements (e.g. cut and fill for railway line)
- Blasting for cut and fill works at the proposed port site and along the proposed infrastructure corridor
- General construction works associated with the construction of various buildings and storage facilities
- Wheel-generated dust from heavy and light vehicle movements on unsealed surfaces
- Diesel exhaust emissions from the use of construction machinery, vehicles and generators.

Dust emissions cause elevated levels of PM_{10} that have the potential to impact on human health and larger particles can impact on amenity primarily by depositing on surfaces such as dwellings and vehicles.

Air Emissions from Rail Transport of Iron Concentrate

Potential air emissions associated with operation of the proposed infrastructure corridor are likely to be associated with:

- Wheel-generated dust from light vehicles travelling along the rail maintenance track
- Residual dust from the empty rail wagons and from the external walls of the train
- Gaseous emissions from the locomotives. The primary pollutants would be volatile organic compounds (VOCs), oxides of nitrogen (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2) and particulates ($PM_{2.5}$ and PM_{10}).

Wheel generated dust from daily inspections is expected to be minor as there will typically only be one light vehicle travelling along the maintenance track at a given time. Similarly, minimal dust emissions are expected from the rail wagons due to the high level of dust control proposed with closed wagons.

An estimate of locomotive combustion emission rates was calculated using emission factors set out by the USEPA Office of Transportation and Air Quality document *Emission Factors for Locomotives* (USEPA 2009). The data which formed the basis of the locomotive emission rate calculations are presented in Table 10-6.

The calculated locomotive emission rates for pollutants associated with locomotives are provided in Table 10-7.

Table 10-6 Input Data for Locomotive Emission Calculations

Input Variable	Value	Source
Locomotive daily fuel use, L/km	6-7	Iron Road 19 September 2014
Number of locomotives for loaded train	2	Iron Road 5 May 2014
Number of locomotives for empty train	1	Iron Road 5 May 2014
Diesel sulphur content, max, ppm	10	DoE (Australian Government, Department of the Environment, website)
Diesel density, max, kg/m^3	850	DoE (Australian Government, Department of the Environment, website)

Table 10-7 Estimated Emission Rates from Locomotives

Pollutant	Estimated Emission Rate – Empty Train (g/sec)	Estimated Emission Rate –Loaded Train (g/sec)
NO_x	11.1	22.2
CO	1.1	2.2
PM_{10}	0.27	0.55
$PM_{2.5}$	0.27	0.53
SO_2	0.003	0.005
Total VOCs	0.43	0.86

As the extent of locomotive emission controls to be used for the project were not known, the most conservative approach has been used for the estimations by adopting the 'uncontrolled' emission factors. In practice, the new locomotives that will be used would be more fuel efficient and subsequently release less emissions compared with those listed in Table 10-7.

Air Emissions from Port Operations

The main air quality impacts from the proposed port operations will be from dust (including PM_{10}, $PM_{2.5}$ and deposited dust) generated by activities associated with transport, storage and handling of the iron concentrate.

During operations, sources of air emissions are likely to include:

- Unloading of the concentrate from the rail wagons at the rail unloading facility
- Concentrate handling, transferring and conveying at the proposed port site
- Stacking the concentrate on the port site concentrate stockpile
- Wind erosion of the port site concentrate stockpile
- Reclaiming of the concentrate from the port site concentrate stockpile via a bucket-wheel bridge reclaimer system
- Ship loading.

The location of emission sources are illustrated in Figure 10-4. Estimated particulate emission rates for the proposed port operations are summarised in Table 10-8 and Table 10-9.

Figure 10-4 Modelled Locations of Air Emission Sources at the Proposed Port Site

Table 10-8 Estimated Particulate Emissions Rates for the Proposed Worst Case Port Operations Scenario

Activity	TSP Emission Rate (g/sec)	PM_{10} Emission Rate (g/sec)	$PM_{2.5}$ Emission Rate (g/sec)
Rail unloading facility	0.22	0.08	0.03
Stockpile stacking	2.73	1.16	0.41
Stockpile reclaiming	5.07	2.03	0.71
Transfer stations	5.96	2.39	0.83
Wind erosion of stockpile	0.07	0.03	0.01
Ship loader	0.41	0.17	0.06

Table 10-9 Summary of Dust Particle Emissions from Source Areas

Source Area	Description	TSP Emission Rate (g/sec)	PM_{10} Emission Rate (g/sec)	$PM_{2.5}$ Emission Rate (g/sec)
Rail unloading facility and stockpile conveyor	Total of emissions from unloading of trains and transfer onto the conveyor.	1.6	0.6	0.2
Stockpile area	Total emissions from stockpile area including the two transfer stations, stockpile wind erosion, stacking and reclaiming of iron concentrate.	10.9	4.5	1.6
Transfer to ship	Includes one transfer point from one conveyor to another, and ship loading.	1.9	0.8	0.3

Fugitive gaseous emissions from the diesel use of light and heavy vehicles such as VOCs, NO_x, CO and SO_2 were not included in the air emissions study as estimated fuel consumption for proposed port operations is very small and any resulting emissions would be considered trivial when compared to other emission sources.

Air Emissions from Shipping

Various gaseous emissions are expected from vessels while at port, including NO_x, CO, VOCs, $PM_{2.5}$ and PM_{10} and SO_2.

An estimate of shipping emission rates was calculated using the *NPI EETM for Maritime Operations Version 1.2* (DSEWPaC 2012b). The calculations assumed:

- Each ship would have an auxiliary engine which would continue to operate while the ship is berthed
- Each ship would have a boiler which would also continue to operate.

The data which formed the basis of the shipping emission rate calculations are presented in Table 10-10. Emission factors and the estimated emission rates for pollutants associated with shipping are presented in Table 10-11.

Table 10-10 Input Data for Shipping Emission Calculations

Input Information[1]	Value	Units
Number of shipment (calls)	156 [2]	Ships/year
Loading time	2959	Hours/year
Non-loading time	2233	Hours/year
Time in berth	5191	Hours/year
	216	Days/year
Ship time in berth	33	Hours/ship
Ship auxiliary engine power	600 [3]	kW
Ship auxiliary boiler fuel consumption	0.0125 [4]	t/h

Notes:
1. The shipping movement design data above was sourced from Iron Road.
2. The shipments per year specified in Chapter 4 are approximately 145, however a higher number was used for the modelling to represent a worst case
3. The auxiliary power value is a default value as provided in the NPI EETM for Maritime Operations (DSEWPaC 2012b).
4. The auxiliary boiler fuel consumption is a default value as provided in the NPI EETM for Maritime Operations (DSEWPaC 2012b).

Table 10-11 Emission Factors and Calculated Emission Rates for Shipping

Pollutant	Emission Factor (aux engine) kg/kWhr	Emission Factor (aux boiler) kg/tonne	Emission Rate (g/sec)
NO_x	0.0147	12.3	1.48
CO	0.0011	4.6	0.12
Total VOCs	0.00038	0.36	0.04
$PM_{2.5}$	0.0011	1.04	0.11
PM_{10}	0.00114	1.3	0.12
SO_2	0.0111	54	1.21

10.5.2 Predicted Emissions during Construction of CEIP Infrastructure

Wind-blown dust emissions become more of a concern when surface wind speeds are greater than 5 m/s (18 km/hr), which would often be the case within the proposed CEIP Infrastructure construction footprint, particularly at the proposed port site. Disturbance or exposure of ground and soil stockpile surfaces through construction activities would further increase the susceptibility of the surface to wind erosion (refer to Appendix J for additional details in relation to wind direction and speed).

Qualitative Dust Impact Assessment for Construction of the Proposed Port

During construction at the port site, the likely air quality effects will be predominantly from dust-generating activities, including vehicular movement in and around the construction zones, earthworks and excavation activities, and exposure of loose materials to wind erosion such as stockpiles. A Construction Environmental Management Plan (CEMP) will be implemented at the port site to minimise and monitor dust emissions during the construction period.

It is expected that the impact of dust emissions on surrounding sensitive receivers during construction of the proposed port will be **low.** This is because the construction earthworks material movement is expected to be substantially less than the material movement during port operations, dust emissions from construction earthworks are expected to be easily controlled using conventional dust mitigation measures such as water carts and water sprays, the separation distance between the construction activity and sensitive receivers is over 1 km and the construction works are short-term in nature.

Qualitative Dust Impact Assessment for Construction of the Proposed Infrastructure Corridor

Clearing, grubbing, stockpiling, blasting and excavation associated with construction of facilities within the infrastructure corridor (railway, power transmission line and water pipeline) will create sources of emissions. Construction activities are not expected to generate significant quantities of dust, based on the relatively low levels of ground disturbance and short-term duration of construction along the corridor.

A CEMP will be implemented along the infrastructure corridor to minimise dust emissions during the construction period. The closest sensitive receiver is located 140 m from the infrastructure corridor. The impact of construction dust emissions is considered to be **low** based on the transient nature of construction along the infrastructure corridor, limited scale of planned earthworks at any particular site, the separation distance between construction activity and sensitive receivers, the short-term nature of construction works and implementation of standard construction dust control measures.

Qualitative Dust Impact Assessment for Construction of the Proposed Long-Term Employee Village

During construction at the proposed long-term accommodation village site, the likely air quality effects will be predominantly from dust-generating activities, including clearing, grubbing, stockpiling and excavation, vehicular movement in and around the construction zones and areas exposed to wind erosion.

A CEMP will be implemented to minimise dust emissions during the construction period. The impact of construction dust emissions at the long-term accommodation village site is expected to be **low**.

Qualitative Assessment of Exhaust Emission Impacts from CEIP Infrastructure Construction

Diesel exhaust emissions would arise from the use of any construction machinery operating on site, and vehicular movements in and around the site. Combustion emissions include SO_2, NO_x, PM_{10}, and CO. The effects of these gaseous emissions are expected to be insignificant and localised around the emission sources only. Therefore, the impact of these emissions at sensitive receivers is considered to be **negligible**.

10.5.3 Predicted Emissions during Operation of the CEIP Infrastructure Corridor

The only potential sources of dust emissions during operation of the infrastructure corridor are associated with the potential lift-off of dust from rail wagons and wheel-generated dust from light vehicles travelling along the rail maintenance track. Dust generation from corridor operations is expected to be minimal, as the rail wagons containing the iron concentrate will be covered during railway operation and the rail maintenance track will typically be used by only one vehicle at a time. Based on the low levels of dust generation expected and the separation between the proposed railway/rail maintenance track and sensitive receivers, the impact to air quality from dust associated with the operation of the railway line (and other corridor components) is considered to be **negligible**.

Locomotives will emit gaseous emissions due to the combustion of diesel. To predict the potential impact of the gaseous emissions on sensitive receivers along the infrastructure corridor, the typical air quality effects from a single scenario for a representative 1 km section of the railway line were modelled. Four indicative sensitive receivers located between 140 m and 300 m from the proposed railway line were considered in the model. Of the potential gaseous emissions from operation of the railway line, NO_2 has the highest potential to exceed the criteria based on the ratio of emission rates presented in Table 10-7, therefore NO_2 was the focus of the modelling.

The predicted maximum ground level concentration for NO_2 at a sensitive receiver located 140 m from the proposed railway line was 0.126 mg/m^3 which is below the criteria of 0.158 mg/m^3 and includes a background concentration of 0.039 mg/m^3. The speed of the train would also be expected to assist with dispersion of the pollutants. In addition, a lower background concentration of NO_2 is expected in the project area than was used in the model (as background air quality data from Whyalla was used in the model), resulting in a comparatively lower cumulative impact than is predicted. For these reasons, the impact associated with locomotive emissions is expected to be **low**.

10.5.4 Predicted Emissions during Operation of the Port Development

This section presents the air quality assessment results for the operation of the proposed port development. Modelling has been completed for the worst case air emissions scenario which would arise when train unloading to the stockpile and ship loading from the stockpile occur concurrently.

The predicted air emissions are conservative due to the following assumptions:

- Use of lower wind speeds (TAPM generated meteorological file) than measured at Port Lincoln. This is considered a conservative assumption because dust disperses more slowly at lower wind speeds therefore higher ground-level concentrations may occur at close by sensitive receivers
- Modelling of train unloading, concentrate stockpile stacking and reclaiming, and ship loading being undertaken consecutively. This is considered a conservative assumption because these activities will only occur consecutively when a ship is at port
- Modelling based on design material movement rates. Actual material movement, and hence dust emissions could be less, but not more than these rates
- Exclusion of rainfall effects (which increase moisture and therefore reduce dust emissions) from the model which uses a worst case air emissions scenario.

Operations will be adjusted, as and if required, based on forecasting of unfavourable climatic conditions and real-time dust monitoring to manage air emissions within air quality criteria levels. The predicted air emissions for adjusted operations are presented for the 24 hour average PM_{10} and $PM_{2.5}$ concentrations. The modelling included adjusted operations for approximately 100 hours, which is equivalent to 1% of the year, to achieve PM_{10} and $PM_{2.5}$ air quality criteria.

In practice, the need for adjusted operation will be assessed as part of an air quality monitoring programme and will involve active management of dust emissions through implementation of a hierarchy of controls. A hierarchy of controls will prioritise control at the emission source (e.g. concentrate stockpile or ship loader), followed by control of the dispersion pathway, then control at the receiver. The controls at the source may include application of additional water sprays or reduced operations. Controls of the dispersion pathway may include windbreak systems, in the form of either vegetation or engineered structures. The least effective and least acceptable option is to mitigate effects at the receiver and this is rarely considered a suitable option (DRET 2009).

A summary of the predicted ground level concentrations and dust deposition for the proposed port development at nearest sensitive receivers is provided in Table 10-12. The ground level concentrations are illustrated in Figure 10-5 to Figure 10-9. Refer to the Figure 10-1 for the locations of the sensitive receivers.

Table 10-12 Predicted Maximum Ground Level Concentrations at Sensitive Receivers

Sensitive Receiver ID*	PM_{10} 24 hr avg. (ug/m^3)	$PM_{2.5}$ 24 hr avg. (ug/m^3)	$PM_{2.5}$ Annual avg. (ug/m^3)	TSP Annual avg. (ug/m^3)	TSP Deposition ($g/m^2/month$)
37	27.2	12.2	7.1	30.3	2
38	28.5	12.7	7.2	30.4	2
39	29.4	13.1	7.2	30.5	2
40	32.4	14.3	7.3	30.7	2
41	30.2	13.7	7.2	30.4	2
42	43.7	18.8	7.5	31.4	2
43	46.1	20.4	7.7	32.1	2.1
44	40.5	17.7	7.8	33.2	2.1
51	27.5	12.1	7.2	30.6	2
52	27.3	12.2	7.2	30.5	2
53	28.6	12.8	7.2	30.6	2
54	29.2	13.0	7.2	30.5	2
55	30.1	13.4	7.2	30.5	2
65	28.6	13.3	7.1	30.3	2
66	33.4	15.0	7.2	30.4	2
75	32.1	13.9	7.3	31.0	2
76	31.5	13.7	7.3	30.9	2
191	24.8	11.2	7.0	30.1	2
193	26.6	11.8	7.1	30.1	2
194	27.9	12.2	7.1	30.2	2
197	27.3	12.5	7.1	30.2	2
198	34.1	15.3	7.2	30.6	2
203	29.2	13.2	7.2	30.5	2
205	30.7	13.4	7.2	30.7	2
229 – Port Neill grain silos	31.3	14.1	7.2	30.6	2
Port Neill central	28.8	12.7	7.2	30.5	2
Project air quality criteria	50	25	8	90	4

* Note:

- The locations of sensitive receivers have been primarily determined by desktop assessment of aerial imagery and are subject to field and community verification. Although every effort has been made by Iron Road to verify the locations of sensitive receivers, inaccuracies may be present.
- The sensitive receivers have been identified at different stages of the project development and assessment process so are not sequential; however the same sensitive receiver ID numbers are used for the same sites in each Technical Report and Chapter to allow cross-referencing.

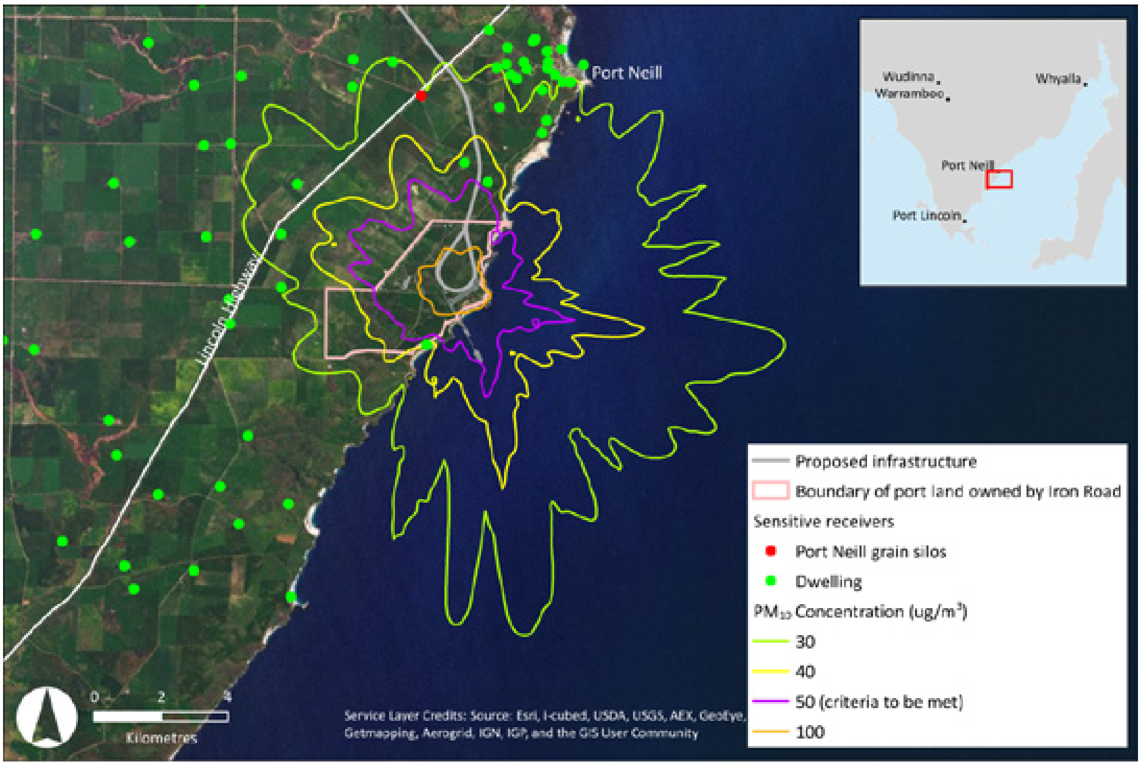

Figure 10-5 Predicted 24-Hour Average PM_{10} Concentrations, Adjusted Operation

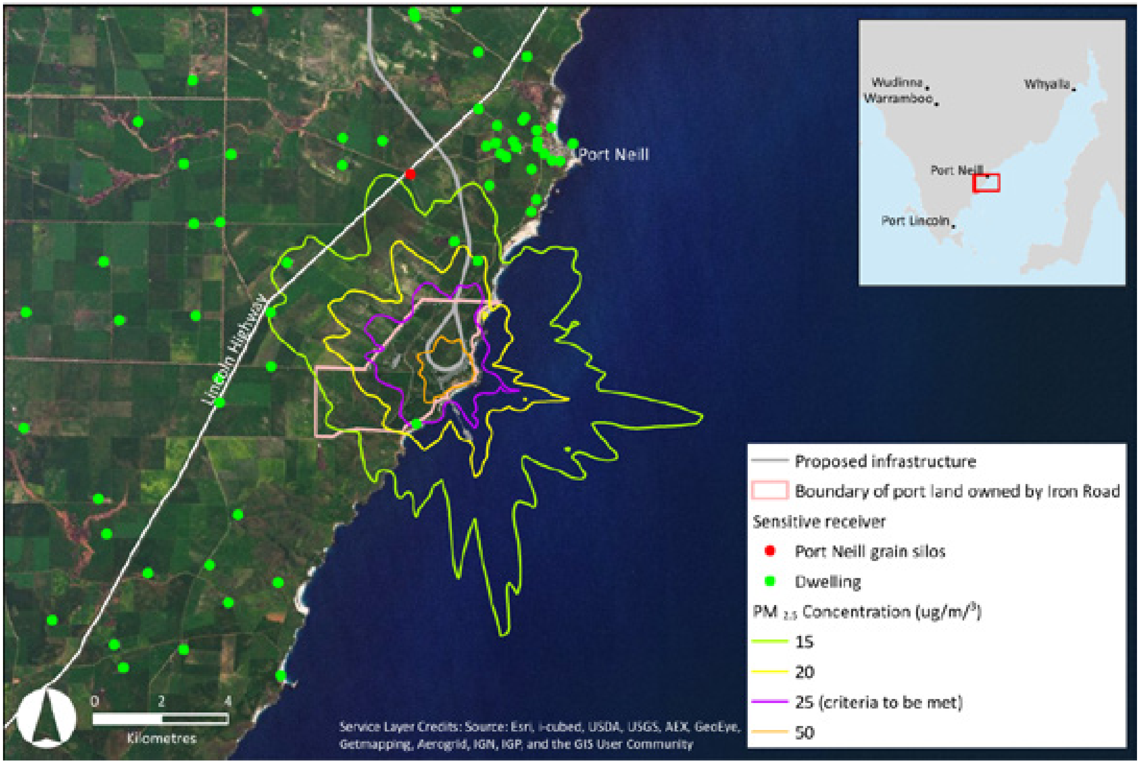

Figure 10-6 Predicted Maximum 24-Hour Average $PM_{2.5}$ Concentrations, Adjusted Operation

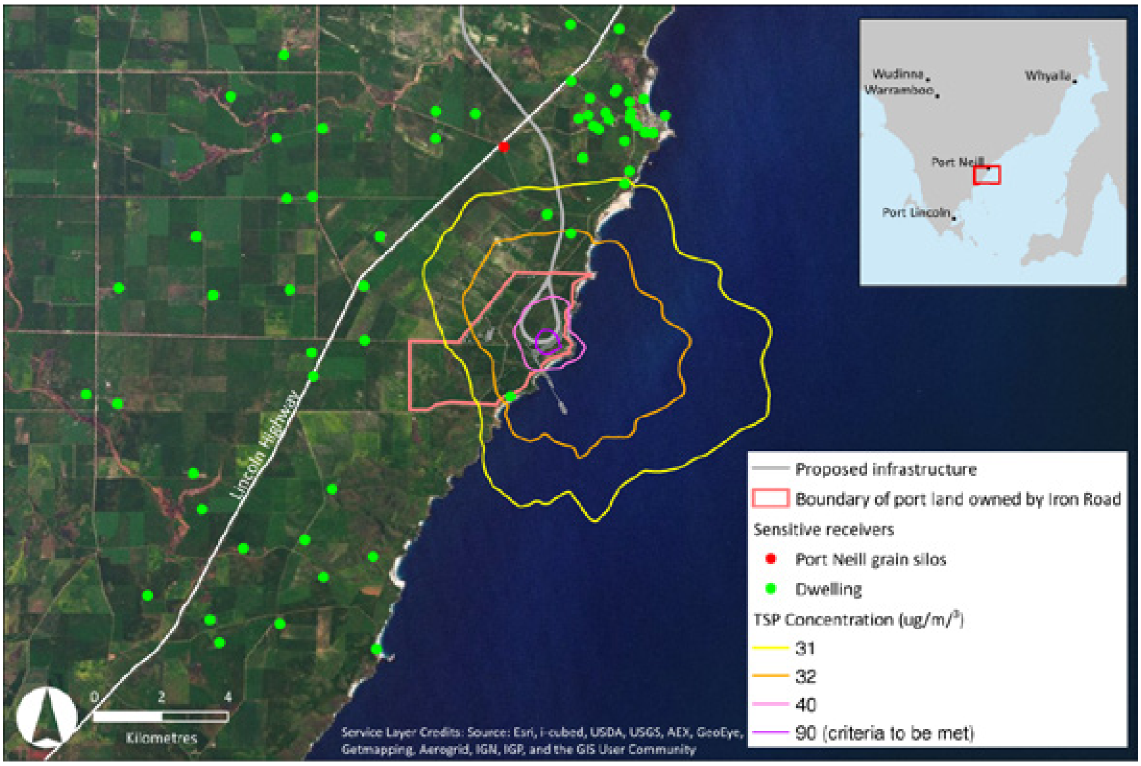

Figure 10-7 Predicted Annual Average TSP Concentration

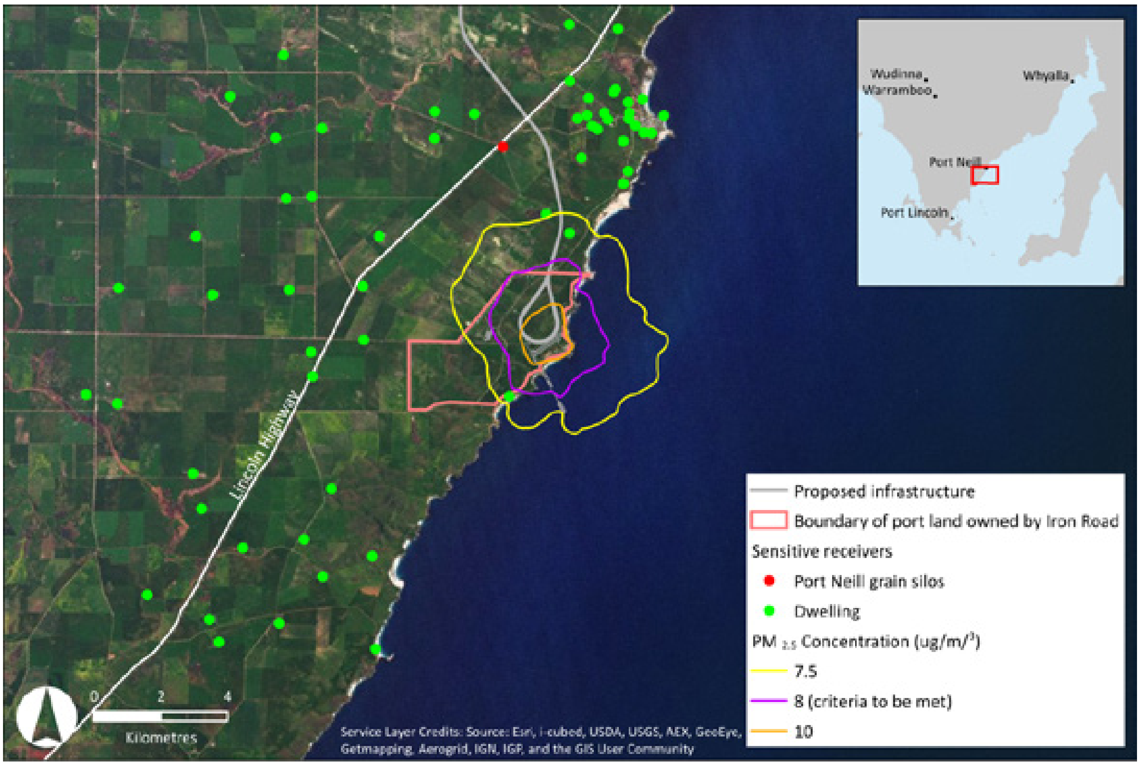

Figure 10-8 Predicted Annual Average $PM_{2.5}$ Concentrations

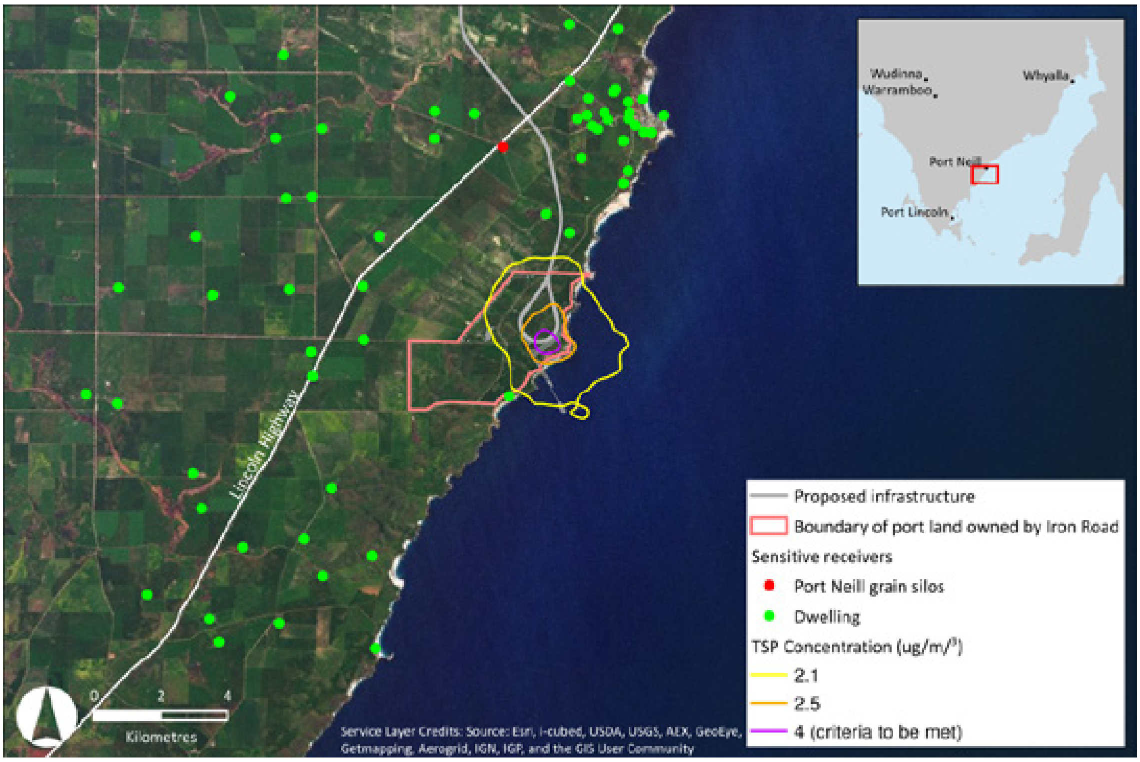

Figure 10-9 Predicted Annual Average Dust Deposition Levels (g/m^2/month)

As demonstrated by the modelling of dust emissions presented above, all relevant air quality criteria will be met at sensitive receiver locations surrounding the proposed port development. Therefore, the impact of these emissions at sensitive receivers is considered to be **low**.

10.5.5 Summary of Impacts

The residual impacts to air quality due to the construction and operation of the proposed CEIP Infrastructure are presented in Table 10-13 (infrastructure corridor and long-term employee village) and Table 10-14 (port).

Table 10-13 Air Quality Impacts: Infrastructure Corridor and Long-Term Employee Village

Impact	Comment	Level of Impact
Construction		
Impacts to sensitive receivers from dust emissions associated with construction of the infrastructure corridor.	Ground disturbing activities such as clearing and excavating, stockpiling and vehicles travelling around the site are likely to generate dust. To mitigate this, ground disturbing activities will be minimised where possible, water trucks will be used on unpaved roads and a vehicle speed limit will be enforced.	Low
Impacts to sensitive receivers from dust emissions associated with construction of the long-term employee village.	Ground disturbing activities such as clearing and excavating, stockpiling and vehicles travelling around the site are likely to generate dust. To mitigate this, ground disturbing activities will be minimised where possible, water trucks will be used on unpaved roads and a vehicle speed limit will be enforced.	Low
Impacts to sensitive receivers from exhaust emissions from CEIP Infrastructure construction.	The operation of construction machinery are likely to generate exhaust emissions. However, machinery will be regularly inspected and maintained to minimise emissions.	Negligible

Impact	Comment	Level of Impact
Operation		
Impacts to sensitive receivers from dust emissions from infrastructure corridor operations.	Residual dust could be generated from empty rail wagons or the travel of vehicles along the rail maintenance track, however it is expected that dust generation will be minimal as the rail wagons will be covered and the rail maintenance track will likely be used by one vehicle at a time.	Negligible
Impacts to sensitive receivers from gaseous emissions from the operation of the proposed railway line.	The predicted maximum ground level concentration for NO_2 at a sensitive receiver located 140 m from the proposed railway line was 0.126 mg/m^3 which is a conservative prediction and below the criteria of 0.158 mg/m^3.	Low

Table 10-14 Air Quality Impacts: Port

Impact	Comment	Level of Impact
Construction		
Impacts to sensitive receivers from dust emissions associated with construction of the port.	Ground disturbing activities such as clearing and excavating, stockpiling and vehicles travelling around the site are likely to generate dust. To mitigate this, ground disturbing activities will be minimised where possible, water trucks will be used on unpaved roads and a vehicle speed limit will be enforced.	Low
Operation		
Health impacts to sensitive receivers from PM_{10} emissions associated with materials handling at the port.	Modelling of dust emissions associated with the operation of the proposed port development demonstrates that all relevant air quality criteria, including PM_{10}, will be met at the sensitive receivers in the vicinity of the proposed port development.	Low
Health impacts to sensitive receivers from $PM_{2.5}$ emissions associated with materials handling at the port.	Modelling of dust emissions associated with the operation of the proposed port development demonstrates that all relevant air quality criteria, including $PM_{2.5}$, will be met at the sensitive receivers in the vicinity of the proposed port development.	Low
Amenity impacts to sensitive receivers from dust deposition associated with materials handling at the port.	Modelling of dust emissions associated with the operation of the proposed port development demonstrates that all relevant air quality criteria, including dust deposition, will be met at the sensitive receivers in the vicinity of the proposed port development.	Low
Amenity impacts to sensitive receivers associated with TSP generated from materials handling at the port.	Modelling of dust emissions associated with the operation of the proposed port development demonstrates that all relevant air quality criteria, including TSP, will be met at the sensitive receivers in the vicinity of the proposed port development.	Low

10.6 Control and Management Strategies

In order to minimise the impact on, and potential risks to, the air quality environment of the nearby sensitive receivers during construction and operation, a series of control strategies and management approaches will be incorporated into the CEMP or OEMP and implemented for each project component. Key control and management strategies are summarised in Table 10-15. Chapter 24 provides a framework for implementation of these strategies and a register of the environmental controls for the whole of the CEIP Infrastructure is presented in Appendix X.

Table 10-15 Control and Management Strategies: Air Quality

Control and Management Strategies	EM ID
Construction	
Regular use of water sprays or suitable chemical wetting agent on susceptible earthen material loads, active earthern stockpiles, particularly during dry or windy conditions (otherwise use covers where appropriate).	PE_C1
Earthern stockpiles to be located as far from sensitive receivers as practicable.	PE_C2
Vegetation to be retained on site where possible, and establishment of additional native vegetation to occur as soon as practicable.	PE_C3
Temporary haul roads to be constructed of compacted gravel or similar and kept in good condition.	PE_C4
Use of water trucks or chemical wettings agents where appropriate on unpaved roads or other exposed areas.	PE_C5
Windbreaks, silt fences and water sprays to be used where appropriate on exposed work areas to reduce wind-generated dust, especially during windy conditions of dry summer months.	PE_C6
Use of a truck-wheel wash grid for trucks leaving the site (for those having trafficked any unsealed roads) where appropriate.	PE_C7
Vehicle speed limits will be managed in accordance with construction traffic management plans and site conditions to mitigate wheel-generated dust.	PE_C8
Maintenance of the complaints and ideas hotline (refer to Chapter 22).	PE_C9
Should visible air quality impacts be clearly observed (e.g. visible dust plumes being emitted off-site), relevant work activities will be reduced or ceased to stop the impacts and alternative work methods implemented prior to recommencing activities.	PE_C10
Operation	
Maintenance, inspection and verification requirements for dust control equipment and technology.	PE_01
Regular maintenance of vehicles and rail wagons.	PE_02
Monitoring programme to confirm compliance with the air quality criteria for the project. The dust monitoring programme will focus on the sensitive receivers with the greatest potential for air quality impacts. Monitoring will also enable modification of activities in response to the following triggers: · Predicted increased dust emission risk from weather forecast information (e.g. very high wind speeds) · Warnings or exceedance alarms from real-time dust monitoring at selected sites around the port facility · Observations(s) of significant dust generation during visual monitoring It is proposed that monitoring be undertaken to allow for the implementation and/or application of reactive mitigation if leading indicators are exceeded.	PE_03
Active operational control informed by the air quality monitoring programme to manage dust emissions within the air quality criteria.	PE_04

10.7 Residual Risk Assessment

This section identifies and assesses air quality risks to surrounding sensitive receivers that would not be expected as part of the normal operation of the CEIP Infrastructure, but could occur as a result of faults, failures and unplanned events. Although the risks may or may not eventuate, the purpose of the risk assessment process was to identify management and mitigation measures required to reduce the identified risks to a level that is acceptable to the project. The air quality management and mitigation measures identified are presented in Section 10.6 and form the basis of the Environmental Management Framework presented in Chapter 24.

Through the adoption of design modification or specific mitigation measures, all identified risks were reduced to low, and are as low as reasonably practicable and are therefore considered acceptable to the project. The key environmental risks will be monitored through the CEIP environmental management framework.

10.7.1 Construction Air Quality Risks

During construction, the residual risks to air quality for sensitive receivers near to the CEIP Infrastructure may include:

- *Unfavourable weather conditions (drier or windier than anticipated) causing additional wind-blown dust.*

  The air quality consequence of additional wind-blown dust being generated during construction due to unfavourable weather conditions would be localised and cause a short-term exceedance of air quality standards, therefore is categorised as minor. It is considered possible that unfavourable weather will occur during the construction period. With a minor consequence and possible likelihood, the risk is considered to be **low**.

- *Failure by construction crews to implement the controls or inadequate control measures specified in the CEMP which fail to effectively manage dust.*

  Construction-generated dust due to failure or inadequacy of controls would be localised and may cause a short-term exceedance of air quality standards, therefore is categorised as minor. It is considered possible that dust controls will fail or be inadequate during the construction period. As the consequence is considered minor and likelihood possible, the risk is considered to be **low**.

- *Greater ground disturbing activities than anticipated during the air quality assessment resulting in higher than predicted dust generation.*

  If the scale of earthworks and ground-disturbing activities is greater than expected, the dust would be localised and may cause a short-term exceedance of air quality standards, therefore the consequence is categorised as minor. It is considered unlikely that the earthworks or ground disturbing activities will be greater than expected because the proposed infrastructure is well defined and feasibility studies have been completed. Due to the consequence being considered minor and likelihood being unlikely, the risk is considered to be **low**.

10.7.2 Operational Air Quality Risks

During operation, there are a number of residual risks including:

- *Excessive dust emissions from rail wagons resulting from iron concentrate that has been improperly loaded or unloaded either from a procedural or equipment failure.*

  The air quality consequence of release of more than expected dust from the rail wagons would be minor as it would be localised (as the dust would be blown off train after a short distance travelled) and may cause a short-term exceedance of air quality standards. It is considered possible that a procedural or equipment failure would occur to cause this during the project life. Due to the consequence being considered minor and likelihood being possible, the risk is considered to be **low**.

- *Background dust levels are higher than predicted at the proposed port site resulting in additional exceedances of the air quality criteria during abnormally dry or windy weather.*

  More exceedances of air quality standards than expected, due to an under estimate of the background dust levels used in the dust modelling, would be localised (limited to the closest sensitive receiver) and short term, therefore would be of minor consequence. Although conservative background dust levels have been incorporated in the dust modelling, it is considered possible that the levels are higher than expected as local air quality monitoring was not completed. With a minor consequence and possible likelihood, the risk is considered to be **low**.

- *Spill of iron concentrate along the proposed railway line from a train derailment or accident.*

  The air quality consequence of a train accident or derailment along the proposed railway line would be moderate, as although the wagons will be covered minimising the amount of spillage, the length of the train will be 1.3 km therefore potentially causing a widespread event with a short-term exceedance of air quality standards. Due the strict rail operational safety and environmental procedures required by regulators, it is considered rare that such an accident or derailment would occur. It should also be noted that the iron concentrate product is easily detected and recovered (it is magnetic) if required. As the consequence is considered moderate and likelihood rare, the risk is considered to be **low**.

- *Excessive dust due to operational equipment or controls failure along the proposed railway line or at the port site.*

  Operations-generated dust due to equipment failure or inadequacy of controls would be localised and may cause a short-term exceedance of air quality standards, therefore is categorised as minor. It is considered possible that equipment or controls will fail or be inadequate during the project life. As the consequence is considered minor and likelihood possible, the risk is considered to be **low**.

- *Higher than predicted dust generation from the port site concentrate stockpile or exposed areas at the proposed port site.*

  Even if higher than predicted dust generation occurs at the proposed port development, the air quality consequence would be localised and cause short-term exceedances of air quality standards, therefore is categorised as minor. Only short-term exceedances would be expected as operational controls would be responsive to results of the air quality monitoring programme. It is considered unlikely that dust emissions will be higher than predicted as the dust modelling presents a conservative scenario (as explained in Section 10.5.4). Due to the consequence being considered minor and likelihood being unlikely, the risk is considered to be **low**.

10.7.3 Summary of Risks

The residual risks associated with project air emissions are presented in Table 10-16. Through the adoption of design modification or specific mitigation measures, all identified risks were reduced to levels of medium or lower. Risks will be monitored through the CEIP environmental management framework.

Table 10-16 Residual Risk Assessment Outcomes: Air Quality

Risk Event	Pathway	Receptor	Project Phase	Consequence	Likelihood	Residual Risk
Excessive dust emissions during construction.	Unfavourable weather conditions; failure to implement management controls; controls inadequate.	Sensitive receivers	Construction	Minor	Possible	Low
Excessive dust emissions during construction.	Greater ground disturbing activities than anticipated.	Sensitive receivers	Construction	Minor	Unlikely	Low
Excessive dust emissions from rail wagons, travelling between proposed mine and port site.	Failure of rail loading procedures/dust control mechanisms; residual dust in empty wagons on return trip.	Sensitive receivers Local flora and fauna	Operation	Minor	Possible	Low
Actual background levels of PM_{10} and $PM_{2.5}$ at the proposed port site are higher than expected.	Local dust storms, abnormally dry weather.	Sensitive receivers	Operation	Minor	Possible	Low
Spillage of iron concentrate along the proposed railway line.	Train derailment/ accident.	Sensitive receivers Local flora and fauna	Operation	Moderate	Rare	Low
Dust event from equipment or controls failure/ poor performance.	Failure of dust control mechanisms (inadequate/ ineffective); unplanned, abnormal or emergency equipment failure.	Sensitive receivers Marine environment Local flora and fauna	Operation	Minor	Possible	Low
Higher than expected dust from concentrate stockpile or exposed areas at the proposed port site.	Failure of dust control mechanisms (inadequate/ ineffective); emissions source not included in model.	Sensitive receivers	Operation	Minor	Unlikely	Low

10.8 Findings and Conclusion

The assessment of air quality impacts has identified the sensitive receivers potentially affected by air emissions associated with the CEIP Infrastructure, determined predicted particulate matter concentrations, dust deposition levels and gaseous emissions at sensitive receiver locations near the proposed port site and railway line, and compared them with regulatory criteria.

A low/negligible level of air quality impact associated with the short duration construction is anticipated.

The most significant source of emissions from the operation of the CEIP Infrastructure is expected to be dust from materials handling at the port site, however modelling of dust emissions demonstrate that all relevant air quality criteria will be met and the potential impact has been therefore categorised as low.

Mitigation measures will be implemented to reduce the potential for dust impacts and risks at the nearest sensitive receivers to the proposed CEIP Infrastructure. Operational air quality monitoring will be undertaken at the proposed port site to assess ongoing compliance with the relevant air quality criteria and to facilitate adjustment of operations and/or management practices if and where required.

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