HANCOCK PROSPECTING PTY LTD

Alpha Coal Project Environmental Impact Statement

13 Air Quality

Section 13 Air Quality

13.1 Introduction

This section presents the findings of the air quality assessment undertaken for the concept design of the Alpha Coal Project (Rail) (herein referred to as the Project). Desktop analysis and modelling has been conducted to determine the potential impacts associated with the Project. Full details of the assessment are provided in Volume 6, Appendix H.

13.2 Description of Environmental Values

13.2.1 Existing Sources of Air Pollutants

The landscape along the 495 km long Project corridor is rural and the air quality is generally very good due to minimal emission sources. At present the bulk of air pollution around the Project corridor is particulate matter originating from scrub fires, agricultural burning and to a lesser extent from natural wind erosion. Fine particulate matter is typically related to dust and smoke emissions as the finer particles are respirable, that is, can be inhaled by humans and other animals and potentially result in health effects.

Scrub fires may be natural as they are caused by natural events such as lightning strikes, while agricultural burning is anthropogenic as it is caused by human influence. These events are intermittent and may lead to significant elevations in airborne particulate matter concentrations during fire events. Smoke from these low-temperature fires typically produces a higher proportion of fine particulate matter, with the proportion of particulate matter less than 2.5 micron ($PM_{2.5}$) typically making up the bulk of particulate matter less than 10 micron (PM_{10}).

While wind erosion does not typically result in such elevated levels of particulate matter concentrations compared to fires, it is a more frequent source of particulate matter in air. Wind speeds around the Project area are not typically strong enough to re-suspend larger particles into the air. Consequently the majority of dust generated by natural wind erosion will be composed of particles less than 10 microns (PM_{10}) (GHD, 2010). In coastal areas, sea salt can also contribute to particulate matter.

The proposed Project corridor passes several existing mines and quarries which would give rise to dust emissions and also potential emissions of methane.

Exhaust emissions from fuel burning vehicles and equipment also contains particulates and other pollutants such as oxides of carbon and nitrogen as well as volatile organic compounds. However, in rural areas, where the overall numbers of vehicles and fuel burning equipment are low, concentrations of pollutants from this source are unlikely to be measurable more than a few metres from the source. Vehicles moving on dirt roads can also result in localised dust emissions that are usually short lived.

There is no existing data available for the average concentrations of PM_{10} and $PM_{2.5}$ within the Project area. The Air Impact Assessment for the Sonoma Project, conducted by Parsons Brinckerhoff (PB) in 2005 near Collinsville assumed a background PM_{10} concentration of 16.8 µg/m^3. In the absence of site specific data, the same value has been adopted for the Project. However, the background PM_{10} value may be slightly higher at some locations along the Project due to:

- natural regional inland conditions; and

- the presence of industry and other physical facilities (i.e. coal mine) along the Project corridor which can either act as a buffer zone or an additional source.

While there is no existing data along the Project corridor, background values for all other constituents are considered to be negligible as the area is remote with a very low number of significant anthropogenic sources.

Dust deposition sampling recently conducted within the Sonoma project site (post mine commissioning and subsequent to the PB modelling) have resulted in an adopted deposition background of 65 $mg/m^2/day$ (corresponding to about 2 $g/m^2/month$).

13.2.2 Climate and Meteorology

The climate along the Project corridor can be considered to be subtropical, with a sub-classification consisting of 'distinctly dry winter'. A subtropical climate generally consists of a warm, wet summer ('wet season') lasting from October to April, along with a mild, dry winter ('dry season') lasting from May to September.

Daytime summer maximum temperatures are mostly warm in the low to mid 30s with a peak in December/January, while minimum winter overnight temperatures are mostly mild between 6 and 13 degrees in June/July.

The annual mean rainfall is dominated by the warm months producing convectively driven rainfall. The five month period November through March accounts for over 68% of the annual mean rainfall (henceforth referred to as the wet season). The wettest months occur in February near the coast, and January further inland, while driest months occur in September near the coast and in August further inland.

An analysis of relative humidity throughout the year, at the morning and afternoon observing times, indicates that the highest humidity conditions occur during the wetter summer months (66% at 9 am and 47% at 3 pm), with the lowest occurring in the dryer winter months (66% at 9 am and 40% at 3 pm).

The area of the Project is located at a low latitude of around 20º C, and is therefore principally affected by easterly trade winds, which are warm and moist at low levels, and dry aloft. There are very little intervening topographical features, (the surrounding area has low to insignificant topographical relief) and the site is not unduly influenced by coastal effects (such as sea and land breezes), except for the coastal strip 50 to 100 km inland from Bowen.

An average annual wind speed of 2.35 m/s has been adopted for the Project. The distribution of flows annually are predominantly from the east, including northeast and southeast (comprising of 74% of incident winds), with a low distribution from the south (6% of winds) and north (5% of winds) directions. The observed wind speed distribution indicates the largest proportion of high wind speeds (> 6m/s) from the east and northeast.

Prevailing wind directions vary seasonally, with the wet season being predominantly east to northeast (27.8% of incident winds) and southeast to south-southeast (28.0% of incident winds) while the dry season is predominantly east to north-easterly (35.4% of incident winds) and a secondary northerly peak (11% of incident winds). The seasonal incidence of high winds (>6 m/s) is greatest in the wet season while the incidence of light (<2 m/s) winds is greatest in the dry season.

During the dry season, which is associated with predominantly light winds, the direction of wind is predominantly south east due to the direction of cool air drainage flows down-slope of the broad river valleys. These drainage flows are likely to be associated with high stability, and can be expected to define the directions of poor dispersion for 'line' sources. During the wet season (warmer months) greater proportion of higher winds (>6m/s) directed from the east to north-east are due to the effects of the sea breeze reinforcing the trade winds from the Pacific Ocean.

Neutral stability conditions occur most frequently and along with prevailing wind direction can indicate the most common direction for potential pollutant impact. Under slightly and moderately stable night-time conditions, pollutant emissions result in a downwind plume that is detectable to a greater distance than during the day.

Stable wind conditions occur 25% of the time with the directions mostly from the east-northeast (14.3% incidence). Stable wind conditions occur when dispersion is poor, as vertical mixing of air is suppressed. Stable atmospheric conditions occur in the absence of strong gradient winds, and mostly on nights with clear skies. They are often associated with ground-based radiation inversions.

Seasonal variation trends in atmospheric stability include:

- in the wet season, the peak incidence of stable winds is from the east to northeast (7%); and
- in the dry season, stable winds predominate from the east to northeast (9.3%) with a lesser extent from the southeast to south-southeast (6.9%).

13.2.3 Relevant Air Quality Criteria

13.2.3.1 State and Federal Standards

Schedule 1 of the *Queensland Environmental Protection (Air) Policy 2008* (EPP (Air)), contains a list of air quality goals corresponding to the maximum allowable levels for atmospheric contaminants (air quality indicators), applicable at all locations outside a dwelling or workplace. The impacts of emissions to air from construction and operation activities are to be assessed against the EPP (Air) air quality objectives. These goals are almost identical to those laid out in the *National Environment Protection Measure for Ambient Air Quality* (NEPM Air).

The Terms of Reference (TOR) for this Project specifies that the predicted emission levels also be compared with the NEPM (Air). The NEPM (Air) is designed as a framework for the assessment of air quality monitoring (rather than modelling) and the air quality goals listed therein are applicable to monitoring results taken at a location that is representative of the general population.

13.2.3.2 Environmental Values

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

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

13.2.4 Sensitive Receptors

Air quality impacts can affect humans, animals and plants, all of which must be considered as sensitive receptors to particulate emissions.

Table 13-1 lists potential sensitive human receptors identified within 500 m of the Project (refer to Volume 3, Section 7, Figure 7-1 of this EIS). These receptors have been identified on the basis of aerial photography and have been assumed to be habitable dwellings.

Table 13-1: Sensitive receptors

Site	Easting	Northing	Distance from proposed track (meters)	Description
1	587079	7701147	113	Potential dwelling[1]
2	549381	7748039	260	Potential dwelling

The Project also passes several other areas relevant in terms of sensitive receptors:

- areas of Class A – Good Quality Agricultural Land (GQAL), being land suitable for cropping. Dust deposition may affect growth and health of crops (refer to Volume 3, Section 5.2.2 of this EIS); and
- areas of sensitive habitat. The main areas of sensitive habitat traversed by the Project are the Caley Valley Wetlands (refer to Volume 3, Section 10.2 of this EIS) and some areas of Endangered Regional Ecosystems and threatened ecological communities (refer to Volume 3, Section 9.2 of this EIS).

In future, if industrial development occurs within the Abbot Point State Development Area (APSDA), there may be workers at facilities adjacent to the Project in APSDA that may be sensitive to operational particulate emissions from the Project.

13.2.4.1 Particulate Matter Criteria

A comparison of the EPP (Air) and NEPM (Air) objectives and goals for PM_{10} and $PM_{2.5}$ show that they are almost identical (refer to Table 13-2). Note that within the NEPM (Air), the objectives for $PM_{2.5}$ are listed as *advisory reporting standards* only because insufficient data have been gathered to define a specific goal. As such, the number of permissible exceedances per annum is not specified. In adopting the NEPM (Air) objectives, the EPP (Air) interprets this lack of specification as allowing zero/nil exceedances per annum. Given that the NEPM allows five exceedances of the PM_{10} goal per annum to account for natural events such as bush fires (common to the area) or 'dust storm' events, it is likely that once sufficient NEPM-reported data have been collected by state jurisdictions to define specific goals for $PM_{2.5}$ that a number of exceedances will be permitted per annum.

Criteria presented in Table 13-2 relates to human health effects and not to effects on other animals and plants. Criteria for effects of particulate matter on non-human animals and plants are not available for Australia.

[1] The sensitive receptors have been identified on the basis of aerial photography. It has been assumed that the receptors are habitable dwellings.

Table 13-2: Relevant criteria – particulate matter

	Air Quality Indicator	Criterion, µg/m^3	Averaging Period	Permissible non-compliances
EPP (Air) and NEPM (Air)	$PM_{2.5}$	25	24 hours	-
		8	1 year	-
	PM_{10}	50	24 hours	5 days each year
EPP (Air)	Total Suspended Particles (TSP)	90	1 year	

The presence of larger suspended dust particles, greater than 35 micron, is likely to affect amenity by way of reducing visibility (whilst in the air column) and by soiling of materials via dust deposition.

Background particulate levels can vary considerably with events such as fires and strong winds. Since there is limited or no control over the variability in background dust levels (widespread sources), dust criteria must be considered in this context, and regardless of the criteria, the focus must be to mitigate the generation of local dust during construction and limit coal losses during operational activity (GHD, 2010).

13.2.4.2 Criteria for other Constituents

The criteria for other constituents (those that result from combustion of fossil fuel and which are ubiquitous in populated areas) are also identical in the state and federal spheres. Table 13-3 shows the corresponding criteria for EPP (Air) and NEPM (Air). Note that the NEPM (Air) does not specify any criteria for Benzene, Toluene or Xylenes. The criteria presented in Table 13-3 represents human health criteria.

Table 13-3: Relevant gaseous pollutant criteria

	Air Quality Indicator	Criterion, µg/m^3 at 0°C	Averaging Period	Permissible non-compliances
EPP(Air) and NEPM (Air)	Carbon Monoxide	11,000 (9.0 ppm[1])	8 hours	1 day each year
	Sulphur Dioxide	570 (0.20 ppm[1])	1 hour	1 day each year
		230 (0.08 ppm[1])	24 hours	1 day each year
		57 (0.02 ppm[1])	1 year	-
	Nitrogen Dioxide	250 (0.12 ppm[1])	1 hour	1 day each year
		62 (0.03 ppm[1])	1 year	-
EPP(Air)	Benzene	10	1 year	-
	Toluene	4,100	24 hours	-
		410	1 year	-
	Xylenes	1,200	24 hours	-
		950	1 year	-

1 Converted from ppm to µg/m^3 at zero degrees Celsius.

13.3 Potential Impacts and Mitigation Measures

13.3.1 Overview

Potential impacts from the Project corridor include possible effects to human health and wellbeing, the health and biodiversity of ecosystems, the aesthetics of the environment and agriculture. These arise from emissions to air from construction activity, surface and construction vehicles, diesel powered locomotive engines and fugitive coal dust from coal trains in transit.

13.3.2 Construction Phase

13.3.2.1 Potential Impacts

During construction (and in the event of decommissioning) of the Project dust emissions will arise from:

- disturbance of exposed soils from the movement of construction vehicles and equipment;
- wind erosion of exposed soil surfaces and stockpiles; and
- exhaust emissions from the range of motor vehicles and mobile plants required for the Project.

The impact from vehicle exhaust during the construction phase is likely to be negligible given the short-term construction period at any one location.

The impacts of dust emissions fall under two distinct categories, being health and amenity.

Potential health impacts are attributable to the concentration of respirable particles in ambient air. Respirable particles of dust have an aerodynamic equivalent diameter of 10 microns or less and are otherwise known as PM_{10} with a finer fraction of $PM_{2.5}$ (being a subset of PM_{10} which is also important). PM_{10} emissions will have maximum impact under light winds and stable atmospheric conditions. These conditions occur most frequently overnight and very early in the morning. These times are generally outside construction hours of activity when confined to day shifts.

Amenity impacts relate to visible dust plumes as well as deposition of dust on buildings and materials. Amenity issues tend to be associated with larger dust particles rather than the small particles that cause health effects.

Most dust emissions will be directly associated with the Project construction corridor. Dust emissions may also occur from construction related vehicles moving along public roads and access tracks to reach the alignment, and from works associated with construction camps. Ballast and other material required to be imported to the construction site will come from authorised quarry operations which will be subject to separate compliance requirements. As such, this source is not considered further. Stockpiles and storage areas on site are considered to have a minimal potential impact for dust.

Analysis of the local wind climate indicates a higher occurrence of wind from the east (including both northeast and southeast), which means sensitive receptors to the west (along with northwest and southwest) of the Project corridor would have a higher frequency of exposure to dust potentially emitted from the Project construction. There is a significantly lower occurrence of wind from the north and south, along with infrequent winds from the west (including northwest and southwest) which means that sensitive receptors located to the south, north and east (northeast and southeast) of the Project would have a relatively lower frequency of potential dust exposure.

The potential for air quality impact is greatest at receptors located at the edge of the Project corridor or at construction areas with the level of impact decreasing with distance from the construction areas. Based on previous experience with similar construction projects, dust related impacts are unlikely to be significant at distances greater than 500 m from the source. Enhanced mitigation measures may be required where sensitive receptors occur within 500 m of the alignment, and particularly where sensitive receptors occur within 100 m of the alignment.

There are two residential receptors within 500 m of the alignment, with one located 113 m from the centre line and the other 260 m from the centre line (refer to Volume 6, Appendix H, Section 4.1.1). Both are around chainage 340 km, south of Collinsville and near the Bowen Developmental Road. Without mitigation, both of these receptors may be adversely affected by dust levels, particularly from an amenity point of view. Health related impacts are unlikely given the relatively short term nature of construction activities in the vicinity of individual receptors.

Other sensitive receptors include:

- areas of GQAL Class A, being areas suitable for cropping. Deposition of dust on crops may affect plant growth, as well as the quality of the product. As most crops are grown on annual or shorter cycles, this may be significant, since an entire crop may be affected. Where areas adjacent to the Project are being used for cropping, dust mitigation measures are likely to be required to prevent dust deposition on crops;
- the Caley Valley wetland and permanent watercourses crossed by the Project. Dust plumes may deposit on these waters, with subsequent degradation of water quality. This is discussed further in Volume 3, Section 10.3.2 of this EIS. Dust mitigation measures will be necessary when constructing in any areas that feature permanent surface water within 500 m of the Project; and
- areas of high conservation value native vegetation such as Endangered Regional Ecosystems and threatened ecological communities (refer to Volume 3, Section 9.2 of this EIS). Dust deposition on vegetation may cause short term growth retardation, but plants should quickly recover once construction is complete (refer to Volume 3, Section 9.3.1 of this EIS). Nevertheless, effort will be made to minimise dust deposition impacts in sensitive ecological areas.

Note also that dust control is likely to be required to protect worker health and amenity, and avoid safety issues associated with obscuring visibility that may occur as a result of dust plumes. Workplace health and safety is not addressed here as a separate legislative process exists for this.

Greenhouse gas emissions generated during the construction phase are described in Volume 3, Section 12.2.8 of this EIS.

13.3.2.2 Construction Dust Mitigation Measures

Dust control measures proposed for the Project are drawn from Part 4.5 of the EPA Document *Best Practice Environmental Management – Environmental Guidelines for Major Construction sites (publication 480)*, and include the following measures:

- soil stock piles will be placed in areas protected from the wind and away from public places where possible. Stockpiles will be aligned with prevailing winds to minimise cross sectional area presented to the prevailing wind direction. Spoil stockpiles will be lightly compacted after placement. While most stockpiles will be linear and extend along the Project alignment, where possible, stockpiles will be minimised in dust sensitive areas. Stockpiles will be managed in accordance with development approvals;

- existing vegetation will be retained where possible or cleared areas and stockpiles re-vegetated with fast growing species for rapid coverage to temporarily or permanently stabilise soil;
- construction traffic will be controlled by designating specific routes for haulage and access. Vehicle speeds on unsealed surfaces will be limited to 50 km/hr, or less in sensitive areas;
- all trucks hauling dirt, sand, soil or other loose materials to and from the construction site will be covered when travelling on public roads;
- wheel wash units or rumble pads will be installed where vehicles enter and exit unpaved roads onto paved roads. Wash-off equipment for trucks and any equipment will be available for any vehicles leaving the site to remove excessive dirt, mud or debris from tires and other under-surfaces. Material spillage on sealed roads will be cleaned up as soon as possible;
- all construction vehicles, mobile plant and machinery will be maintained and operated in accordance with the manufacturers' specifications to minimise exhaust emissions; and
- a line of communication will be established between the construction contractor and the local community prior to the start of construction as part of a complaints management system. All complaints lodged by nearby residents will be recorded on a complaints register, which will also document the investigation into the source of the emission giving rise to the complaint, as well as any corrective actions taken to rectify the cause of complaint.

Enhanced mitigations to further reduce construction dust are not likely to be required as there are minimal sensitive receptors within 100m of the proposed alignment. However should dust problems arise, further measures to manage dust can be introduced.

13.3.3 Operational Phase

13.3.3.1 Potential Impacts

The operations phase will involve the combustion of diesel by trains running on tracks above ground with emissions directly entering into the atmosphere. Exhaust emissions from these engines will produce Particulate Matter (PM_{10} and $PM_{2.5}$), Carbon Monoxide, Nitrogen Dioxide, Sulphur Dioxide, Benzene, and Volatile Organic Compounds (VOCs). Also during operations, fugitive coal dust emissions (TSP, PM_{10} and $PM_{2.5}$) are expected to enter the atmosphere from the coal wagons in transit.

In summary, potential sources of air emissions from the operation phase of the Project include:

- exhaust emissions from diesel powered locomotive engines; and
- fugitive coal dust emissions from uncovered coal wagons in transit.

Air pollutant emission rates for train movements have been estimated on the basis of the following:

- exhaust emission data for diesel engines from the National Pollutant Inventory (NPI) *Emissions Estimation Technique Manual for Railway Operations*, (DEWHA, 2008d);
- total one-way track distance of 495 km;
- average coal train capacities of 24,000 net tonnes;

- coal train average diesel fuel consumption of 0.0018 litres per net tonne km;
- 14 movements per day, spread evenly over a 24 hour period (corresponding to maximum production rate of 60 Mtpa);
- train speed of 80 km/h; and
- an emission rate of 5.6 kg/km of TSP from fugitive coal release estimates based on *Environmental Evaluation of Coal Dust Emissions* study (Connell Hatch, 2008) together with a 25% loading to account for coal spillage along the Project corridor.

The resulting emission estimates are shown in Table 13-4 for the entire 495 km route.

Table 13-4 Air pollutant emission rates for 60 Mtpa operations along the Project

Pollutant	Emission rate (kilograms per day) Year 2016
NO_2	6,612[1]
CO	13,742
SO_2	8.9
TSP	19,285
PM_{10}	8,629
$PM_{2.5}$	4,314
Benzene	186
VOCs	2,272

[1] Directly emitted NO_2 from trains is not significant in atmospheric NO_2 concentrations as the emissions of oxides of nitrogen are mainly as the NO component of NOx. Predicted peak nitrogen dioxide emission rates have therefore been based on air quality data that indicates that 28% of NOx is emitted as NO_2 (Yao et al., 2005).

Impacts of dust relate to two key aspects:

- concentrations in air, as this is the exposure pathway for respiration of dust particles; and
- the rate of deposition of dust on plant leaves and other surfaces, since this is the exposure pathway for effects on plant growth, water quality and amenity.

Peak in-air concentrations were modelled using the Gaussian plume model AUSROADS, developed by Environmental Protection Agency (EPA) Victoria. Diesel train emissions are diluted by a complicated emission and mixing process. Buoyancy induced and wind shear induced turbulence occurs behind a moving train which contributes to mixing the emissions, and thus thoroughly mixing the exhaust emissions into the recirculation zone of air behind a travelling train. If the zone of initial mixing is expanded to include a flow of trains travelling on a single track, the emissions can be characterised as a 'line source' of contaminants. For this situation the modelling of railway emissions can be performed using a Gaussian plume model configured to emulate the dispersion of contaminants from this type of line source. The model utilizes a full year of meteorological conditions and thus gives seasonal variations.

Dust deposition was modelled using the regulatory approved dispersion model Ausplume (Version 6) also developed by EPA Victoria, as AUSROADS cannot model dust deposition. The methodology for the dispersion model can be found in Volume 6, Appendix H and the results of the dispersion modelling are discussed below.

Predicted peak in-air concentrations from the combined locomotive emissions and fugitive coal dust emissions are shown in Table 13-5, together with the relevant air quality criteria. In all cases, predicted concentrations were well below the criteria at 10 m from the centre line of the Project track.

Table 13-5: Highest predicted peak incremental impacts (micrograms per cubic metre)

Pollutant	Averaging Period	EPP (Air) Criteria µg/m^3	Predicted peak incremental concentration at distance from the track (metres)					
			10	20	40	50	100	200
CO	8 hours	11,000	17.2	11.4	8.1	7.3	5.1	2.6
SO_2	1 hour	570	0.018	0.012	0.008	0.007	0.004	0.002
	24 hours	230	0.007	0.005	0.003	0.003	0.002	0.001
	1 year	57	0.002	0.0013	0.0008	0.0007	0.0004	0.0002
NO_2	1 hour	250	9.4	6.1	4.0	3.4	2.1	1.2
	1 year	62	1.0	0.7	0.4	0.4	0.2	0.1
Benzene	1 year	10	0.041	0.026	0.017	0.015	0.009	0.005
$PM_{2.5}$	24 hours	25	0.7	0.5	0.3	0.3	0.2	0.1
	1 year	8	0.20	0.13	0.09	0.07	0.05	0.02
PM_{10}	24 hours	50	1.4	1.0	0.7	0.6	0.4	0.2
$PM_{2.5}$	24 hours	25	3.9	2.7	1.9	1.7	1.2	0.6
	1 year	8	1.2	0.8	0.5	0.4	0.3	0.1
PM_{10}	24 hours	50	7.8	5.5	3.9	3.5	2.4	1.2
TSP	1 year	90	6.4	4.1	2.7	2.3	1.4	0.8

The assessment presented in Table 13-5 assumed zero background concentrations of these pollutants. This is valid for most pollutants as there are no other significant sources of these pollutants.

There are both natural and anthropogenic sources of particulates, and a background concentration of 16.8 µg/m^3 was adopted (refer to Section 13.2.4.1 above). If this adopted background level is added to the predicted in-air concentrations, the total PM_{10} concentration at 10 m from the centre line is 24.6 µg/m^3 less than half the established criterion.

Predicted deposition rates for TSP are shown in Table 13-2. Again, the predicted dust deposition rates are well below the relevant criterion, being 11% of the criterion at 10 m from the track.

Table 13-6: Predicted peak dust deposition (gram per square metre per month)

Pollutant	Averaging Period	Criteria (1)	Predicted peak dust deposition rate at distance from the track (metres)					
			10	20	40	50	100	200
TSP	1 year	4 g/m^2/month	0.44	0.28	0.14	0.11	0.04	0.02

(1) Protocol for Environmental Management (PEM) - State Environment Protection Policy (Air Quality Management) for Mining and Extractive Industries, EPA Victoria 1997.

From the above results, during the worst case scenario (the locomotive exhaust together with full coal wagons) and background concentrations included, it can be demonstrated that within 10 m from the Project corridor all predicted concentrations are compliant with the EPP (Air) criteria. The closest sensitive receptor is Receptor 1 (R1) which is 113 m away from the Project corridor (refer to Table 13-1). Even under worst case conditions the highest predicted peak concentrations for PM_{10} and $PM_{2.5}$ are compliant with their EPP (Air) criteria, where at 100 m from the Project corridor are, at most, only 4.8% (both PM_{10} and $PM_{2.5}$) of their respective criteria. Consequently, at the only other identified sensitive receptor (R2), the impact from the Project corridor in peak operation would be negligible, as it is beyond 200 m distance from the Project corridor (R2 is 260 m away from the Project corridor).

Dust deposition results also indicate that impacts on crops and native vegetation are very unlikely. Potential impacts on Caley Valley Wetland are discussed in Volume 3, Section 10.3.3 of this EIS and potential impacts on terrestrial vegetation are discussed in Volume 3, Section 9.3.2 of this EIS.

The air quality assessment has not considered dust arising from maintenance vehicles moving along unsealed access tracks. This source is intermittent and localised and is not expected to have any significant impacts.

One final potential impact may arise from the encroachment of additional sensitive receptors into the rail corridor. However, given the land use patterns along the Project, the only area where development in proximity to the Project might occur is within the APSDA, where industrial and transportation land uses may occur along the alignment. In this case, workers may be exposed to dust from the coal trains. Given that predicted concentrations at 10 m from the centre line are well below the EPP (Air) criteria, it is unlikely that any workers at the APSDA will be exposed to harmful dust levels from the Project.

Greenhouse gas emissions generated during the operational phase are described in Volume 3, Section 12.2.9 of this EIS.

13.3.3.2 Mitigation Options

While the results of the operational air quality assessment indicate that there are no predicted impacts on any sensitive receptors, good practice dictates the following standard management and mitigation measures:

- significant coal spillage (e.g. from a derailment) in the corridor will be cleaned up on as required basis;
- coal loading techniques to reduce parasitic loads and over-filling;
- profiling of the coal load to reduce surface erosion during transport;
- potential modifications to wagons to reduce wind contact with coal during transport; and

- maintain any unsealed vehicle access tracks and impose a 50 km/h speed limit on these tracks.

13.4 Conclusions

The construction of the 495 km long Project corridor from the Galilee Basin to Abbot Point will result in dust emissions along the transport corridor which is proximate to a limited number of sensitive locations. The particulates of emission to air during the construction phase of the Project are expected to come from:

- dust emissions from mechanical disturbance: due to construction and maintenance vehicles/ equipment;
- wind erosion of crustal material: from exposed disturbed soil surfaces under high wind speeds; and
- exhaust emissions from the range of motor vehicles and mobile plants required for the Project.

Analysis of the local wind climate indicates a higher occurrence of wind from the east (including both northeast and southeast). The implication that follows is that sensitive receptors to the west of the Project corridor would have a higher frequency of exposure to dust potentially emitted from the Project construction then do receptors located east of the Project. Thus, the best practice dust control measures outlined in Part 4.5 of the EPA Document *Best Practice Environmental Management – Environmental Guidelines for Major Construction sites (publication 480)* should be sufficient for a Dust Management Framework to be implemented during the construction of the Project.

The air quality assessment did not predict any adverse impacts on identified sensitive receptors:

- predicted emissions of CO, SO_2, NO_2, Benzene, PM_{10} and $PM_{2.5}$ from locomotive exhausts alone from the proposed operation are compliant with EPP (Air) criteria within 10 m of the Project corridor;
- predicted emissions of dust including TSP, PM_{10} and $PM_{2.5}$ from locomotive exhausts combined with the fully loaded coal wagons in transport along the Project alignment are compliant with the applicable EPP (Air) criteria within 10 m of the railway (where $PM_{2.5}$ and PM_{10} are both 15.6% of their respective criteria, while TSP is 7.1% of its criterion);
- applying the adopted background PM_{10} concentration of 16.8 µg/m^3 (refer to Section 13.2.4.1 above) to the highest predicted ground level concentration for the locomotive engine plus wagon in operation, the impact is still predicted to be below the 50 µg/m^3 criterion, where at 10 m from the Project railway the PM_{10} concentration is 24.6 µg/m^3 corresponding to 49% of its criterion; and
- predicted dust deposition from the worst case scenario of locomotive engines plus fully loaded coal wagons is below the 4 g/m^2/month criterion within 10 m from the railway (11% of the criterion) and at both of the sensitive receptors. At 100 m distance from the Project corridor the predicted dust deposition rate with background included is 2.04 g/m^2/month (51% of the criterion), having no significant effect to either of the sensitive receptors or to the environmental values described in Section 13.2.3.2 above.

The operational mitigation options listed in Section 13.3.3.2 above are to further reduce the impact of emissions not only at the sensitive receptors but also to protect the natural environment, human health and the immediate surrounds of the rail facility.