Appendix E

Air Quality and Greenhouse Gas Assessment



Air Quality and Greenhouse Gas Assessment - Balranald Mineral Sands Project

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On behalf of:
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Prepared by:
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Acronyms and Abbreviations

μg/m³	Micrograms per cubic meter
ACARP	Australian Coal Association Research Program
AHD	Australian Height Datum
AQCS	Air Quality Control System
AWS	Automatic Weather Station
BoM	Bureau of Meteorology
CO	Carbon-monoxide
CSIRO	Commonwealth Scientific and Industrial Research Organization
DPE	Department of Planning and Environment
DSI	Dust Storm Index
EIS	Environmental Impact Statement
EMM	EMGA Mitchell McLennan
ENVIRON	ENVIRON Australia Pty Ltd
EPA	Environment Protection Authority
FEL	Front End Loaders
HMC	Heavy Metal Concentrate
IARC	International Agency for Research on Cancer
Iluka	Iluka Resources Limited
ISP	Ilmenite Separation Plant
Km	Kilometers
MSP	Mineral Separation Plant
MUP	Mining Unit Plant
NEPC	National Environmental Protection Council
NEPM	National Environment Protection Measure
NOx	Oxides of Nitrogen
NPI	National Pollution Inventory
NSOB	Non-saline Overburden
OEH	Office of Environment and Heritage

OEHHA	Office of Environmental Health Hazard Assessment
PAF	Potentially Acid Forming Overburden
PM_{10}	Particulate matter with an aerodynamic diameter less than 10µm
$PM_{2.5}$	Particulate matter with an aerodynamic diameter less than 2.5µm
RDR	Rare earth Drum Roll magnetic separators
ROM	Run of Mine
SEARs	Secretary’s Environmental Assessment Requirements
SO2	Sulphur-dioxide
SOB	Saline Overburden
SSD	State Significant Development
TAPM	The Air Pollution Model
TSF	Tailings Storage Facility
TSP	Particulate matter with an aerodynamic diameter less than 30µm
WCP	Wet Concentrator Plant
WRP	Woornack, Rownack, and Pirro mine

Executive Summary

An air quality and greenhouse gas assessment was undertaken for the proposed Balranald Mineral Sands Project (the Balranald Project), a mineral sands mine proposed by Iluka Resources Limited (Iluka). The Balranald Project is located within the Murray Basin in south-western NSW, near the township of Balranald.

The Balranald Project includes construction, mining and rehabilitation of two linear mineral sand deposits, known as the West Balranald and Nepean mines located approximately 12 km and 42 km north-west of the town of Balranald, respectively. Extracted ore will be processed onsite to produce ilmenite and heavy mineral concentrate (HMC).

The study responds to the Department of Planning and Environment (DP&E) Secretary's Environmental Assessment Requirements (SEARs) and is conducted in accordance with the NSW Environment Protection Authority (EPA) Approved Methods for Modelling and Assessment if Air Pollutants in NSW.

Air quality assessment

The key air emissions associated with the Balranald Project are fugitive particulate matter. Emission inventories for three key mine stages were developed based on USEPA AP-42 emission estimation documentation. Air emissions were quantified for all mobile mining equipment (haul trucks, dozers, etc), ore handling and processing, and wind erosion.

Emissions of total suspended particulates (TSP), particulate matter less than 10 microns in aerodynamic diameter (PM_{10}), particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$), a range of trace metal/metalloid pollutants and respirable crystalline silica (RCS) were quantified for conceptual mine plans for Years 1, 4, and 8 of mining operations. These were used to assess the temporal and spatial variations of potential air quality impacts over the life of the Balranald Project.

The calculated annual emissions were input into the USEPA regulatory AERMOD model, populated with site-specific terrain, land use and modelled meteorological input data, in order to undertake atmospheric dispersion modelling. Meteorological modelling was undertaken using a combination of prognostic and diagnostic models (TAPM and CALMET) to derive hourly site-representative meteorological data for use in the dispersion simulations. This method is termed as CALMET Hybrid modelling method within this assessment. Meteorological modelling results were verified based on observations from regional Bureau of Meteorology automatic weather stations.

The air quality assessment provides a conservative (upper bound) estimate of the potential air quality impacts associated with the Balranald Project. Emission reductions associated with management measures to be implemented by the Balranald Project were taken into account where the control effectiveness of measures could be quantified.

Ground level concentrations and dust deposition rates associated with Years 1, 4 and 8 of mining operations were predicted to be within the EPA impact assessment criteria for all assessment locations.

Trace metal/ metalloid and crystalline silica concentrations were predicted to comply with relevant impact assessment criteria for Years 1, 4 and 8 of mining operations.

Generally, the predictions presented in this report incorporate a level of conservatism due to worst case assumptions and the inherent conservative nature of dispersion modelling. As a result, it is expected that actual ground level concentrations would be lower during the normal operation of the Balranald Project.

Greenhouse Gas Assessment

To evaluate the greenhouse gas (GHG) emissions from the Balranald Project and determine its contribution to NSW and Australian annual GHG emissions, emissions were estimated based on information provided by Iluka and relevant GHG emission factors.

GHG emissions were calculated for:

- Direct emissions produced from sources within the boundary of the Balranald Project and as a result of Iluka's activities (Scope 1 emissions); and
- Indirect emissions generated in the wider economy as a consequence of Iluka's activities, but which are physically produced by the activities of another organisation indirectly (Scope 2 and 3 emissions).

The relative significance of GHG emissions from the Balranald Project is qualitatively evaluated by considering the magnitude of such emissions compared to total GHG emissions released within NSW, nationally and globally. The key findings of the assessment are as follows:

- Annual GHG emissions calculated from Year 1 to Year 8 of the Balranald Project (from direct and indirect emissions) were estimated to be between 0.3 Mt and 0.6 Mt of CO2-e/yr.
- Indirect emissions (Scope 2 and Scope 3) are the major contributors of the Balranald Project's GHG emissions.
- Of the indirect emissions, downstream product transport to the international market on average accounts for 80% of indirect emissions.
- Direct emissions generated by the Balranald Project represent between 0.04% and 0.055% of total annual NSW emissions, 0.011% to 0.015% of Australian emissions and between 0.00013% and 0.00017% of global emissions.
- Indirect emissions generated by the Project represent between 0.063% and 0.081% of annual NSW emissions, 0.018% to 0.023% of Australian emissions and between 0.0005% and 0.0012% of global emissions.

1 Introduction

Iluka Resources Limited (Iluka) proposes to develop a mineral sands mine in south-western New South Wales (NSW), known as the Balranald Mineral Sands Project (the Balranald Project). The Balranald Project includes construction, mining and rehabilitation of two linear mineral sand deposits, known as West Balranald and Nepean, located approximately 12 kilometres (km) and 66 km north-west of the town of Balranald, respectively.

ENVIRON Australia Pty Ltd (ENVIRON) has been commissioned by EMGA Mitchell McLennan (EMM) on behalf of Iluka Resources Limited (Iluka) to prepare an Air Quality and Greenhouse Gas Assessment for the Balranald Project.

1.1 Overview

Iluka is seeking development consent under Part 4, Division 4.1 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) for the Balranald Project, broadly comprising:

- Open cut mining of the West Balranald and Nepean deposits, referred to as the West Balranald and Nepean mines, including progressive rehabilitation.
- Processing of extracted ore in the project area to produce heavy mineral concentrate (HMC) and ilmenite.
- Road transport of HMC and ilmenite from the project area to Victoria.
- Backfilling of the mine voids with overburden and tailings, including transport of by-products from the processing of HMC in Victoria back for backfilling in the mine voids.
- Return of hypersaline groundwater extracted prior to mining to its original aquifer by a network of injection borefields.
- An accommodation facility for the construction and operational workforce.
- Gravel extraction from local sources for construction requirements.
- A water supply pipeline from the Murrumbidgee River to provide fresh water during operation.

Separate approvals, are being sought for:

- Construction of a transmission line to supply power to the Balranald Project.
- Project components located within Victoria.

The regional setting for the Balranald Project is shown in **Figure 1**.

1.2 Approval process

In NSW, the Balranald Project requires development consent under Part 4, Division 4.1 of the EP&A Act. Part 4 of the EP&A Act relates to development assessment. Division 4.1 specifically relates to the assessment of development deemed to be significant to the state, known as State significant development (SSD). The Balranald Project is a mineral sands mining development which meets the requirements for SSD.

An application for SSD must be accompanied by an environmental impact statement (EIS), prepared in accordance with the NSW Environmental Planning and Assessment Regulation 2000 (EP&A Regulation).

An approval under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is required for the Balranald Project (with the exception of the transmission line which will be subject to a separate EPBC Act referral process). A separate EIS will be prepared to support an application in accordance with the requirements of Part 8 of the EPBC Act.

1.3 Secretary's environmental assessment requirements

An EIS has been prepared to address specific requirements provided in the Secretary's environmental assessment requirements (SEARs) for the SSD application, issued on 2 December 2014. This Air Quality and Greenhouse Gas Assessment has been prepared to address specific requirements for air quality in the SEARs, summarised in **Table 1**.

Table 1. Relevant SEAR's for this assessment

Requirement	Section addressed
An assessment of the likely air quality impacts of the development in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW and the EPA's additional requirements.	**Entire report**
Reasonable and feasible mitigation measures to minimise dust and processing emissions, including evidence that there are no such measures available other than those proposed	**Section 7.2 and Section** 10
Monitoring and management measures, in particular air quality monitoring	**Section** 10
An assessment of the likely greenhouse gas impacts of the development, dealing with EPA's requirements	**Section 11**

1.4 Purpose of this report

ENVIRON has been commissioned to undertake an Air Quality and Greenhouse Gas Assessment for the SSD application for the Balranald Project.

The Air Quality and Greenhouse Gas Assessment has been carried out accordance with the SEARs and with reference to the following standards, guidelines and policies:

- Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (NSW EPA, 2005a).
- Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (NSW EPA, 2005b).

- The Protection of the Environment Operations (POEO) (Clean Air) Regulation 2010.
- National Greenhouse Accounts Factors – Australian National Greenhouse Accounts – July 2014 (DoE, 2014a).
- Technical Guidelines for the Estimation of Greenhouse Gas Emissions by Facilities in Australia - National Greenhouse and Energy Reporting (NGER) (Measurement) Determination 2008 (DoE, 2014b).
- Guidelines for Energy Savings Action Plans, issued by NSW-Department of Energy, Utilities and Sustainability (NSW-DEUS) hereafter referred to as the 'GESAP'. The GESAP is listed in the Guidance, Policies and Plans section of the SEAR's.
- Second International Maritime Organisation (IMO) – Greenhouse Gas (GHG) Study 2009, published by IMO.
- Australian National Greenhouse Gas Inventory – Kyoto Protocol Accounting Framework.
- NSW Governments Voluntary Land Acquisition and Mitigation Policy

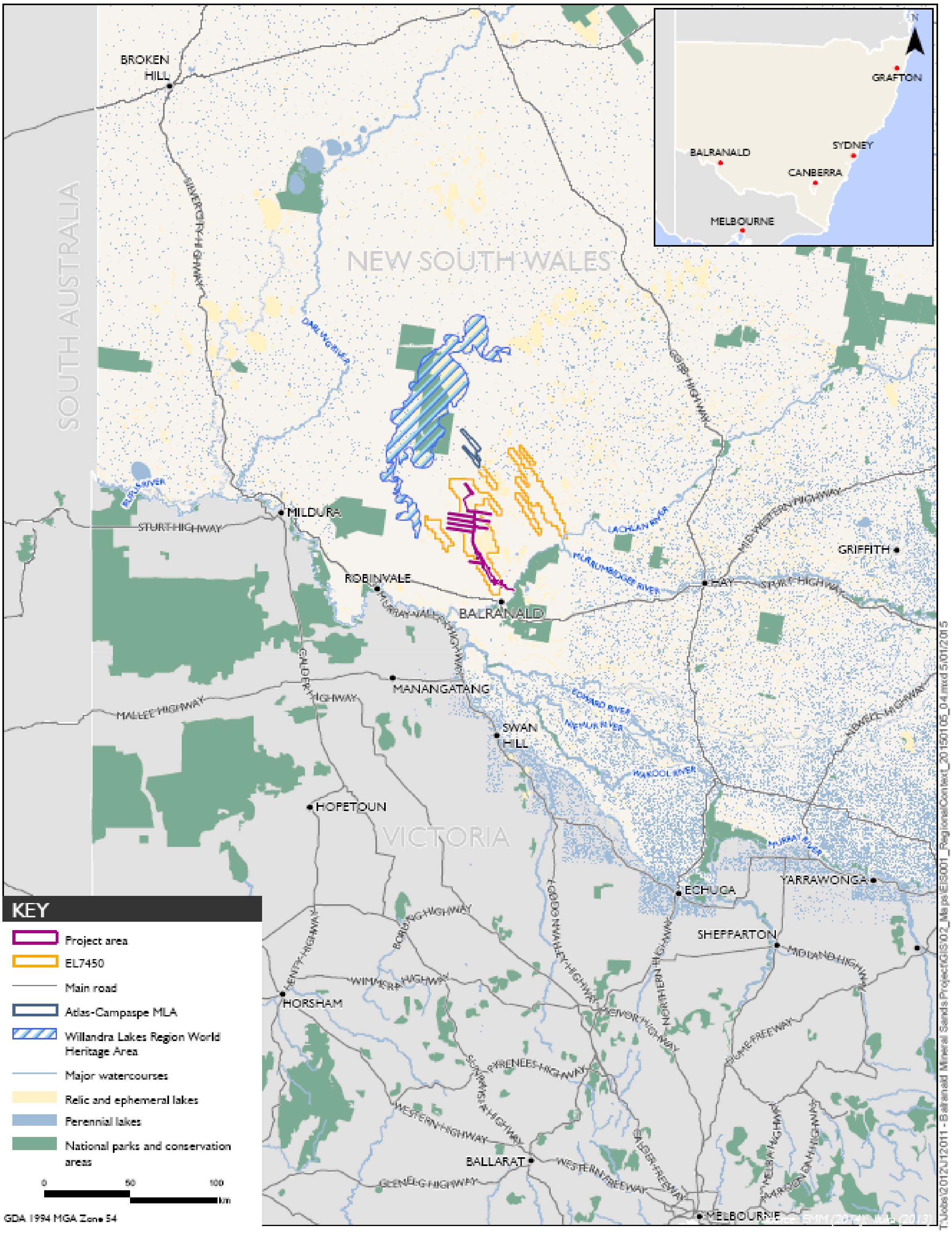

Figure 1. Regional project location

2 Project description

2.1 Project schedule

The Balranald Project will have a life of approximately 15 years, including construction, mining, backfilling of all overburden material, rehabilitation and decommissioning.

Construction of the Balranald Project will commence at the West Balranald mine, and is expected to take about 2.5 years. Operations will commence at the West Balranald mine in Year 1 of the operational phase, which will overlap with approximately the last six months of the construction. The operational phase would include mining and associated ore extraction, processing and transport activities, and would be approximately nine years in duration. This would include completion of backfilling overburden into the pits at both the West Balranald and Nepean mines. Construction of infrastructure at the Nepean mine will commence in approximately Year 5 of the operational phase, with mining of ore starting in Year 6, and being complete by approximately Year 8.

Rehabilitation and decommissioning is expected to take a further two to five years following Year 9 of the operational phase.

2.2 Project area

All development for the Balranald Project that is the subject of the SSD application is within the project area (**Figure 2**). The project area is approximately 9,964 ha, and includes the following key project elements, described in subsequent sections:

- West Balranald and Nepean mines.
- West Balranald access road.
- Nepean access road.
- Injection borefields.
- Gravel extraction.
- Water supply pipeline (from the Murrumbidgee River).
- Accommodation facility.

Within the project area, the land directly disturbed for the Balranald Project is referred to as the disturbance area. For some project elements in the project area, a larger area has been surveyed than would actually be disturbed. This enables some flexibility to account for changes that may occur during detailed design and operation. The project area and disturbance area for each project element are in **Table 2**.

Table 2. Balranald Project – project area and disturbance area		
Project element	**Project area (ha)**	**Disturbance area (ha)**
West Balranald mine	3,059	3,059
Nepean mine	805	805
West Balranald access road	128	52 1
Nepean access road	173	156 2
Injection borefields	5,721	1,214 3
Gravel extraction	42	42
Water supply pipeline	29	11 4
Accommodation facility	7	7
Total	**9,964**	**5,346**

Notes: *1. 60 m wide corridor within project area*
2. 40 m wide corridor within project area
3. 100 m wide corridors within project area
4. 15 m wide corridor within project area

2.2.1 West Balranald and Nepean mines

The West Balranald and Nepean mines include:

- Open cut mining areas (ie pit/mine void) that would be developed using conventional dry mining methods to extract the ore.
- Soil and overburden stockpiles.
- Ore stockpiles and mining unit plant (MUP) locations.
- A processing area (at the West Balranald mine), including a mineral processing plant, tailings storage facility (TSF), maintenance areas and workshops, product stockpiles, truck load-out area, administration offices and amenities.
- Groundwater management infrastructure, including dewatering, injection and monitoring bores and associated pumps and pipelines.
- Surface water management infrastructure.
- Services and utilities infrastructure (eg electricity infrastructure).
- Haul roads for heavy machinery and service roads for light vehicles.
- Other ancillary equipment and infrastructure.

The location of infrastructure at the West Balranald and Nepean mines would vary over the life of the Balranald Project according to the stage of mining.

2.2.2 Injection boreholes

The Balranald Project requires a network of injection borefields in the project area for the return of hypersaline groundwater to the Loxton Parilla Sands aquifer. Within each borefield, infrastructure is generally located in two 50 m wide corridors (approximately 350-400 m apart) and typically comprises:

- a network of pipelines with a graded windrow on either side;
- access roads for vehicle access during construction and operation;
- rows of injection wells, with wells spaced at approximately 100 m intervals; and
- a series of water storage dams to store water during well development.

2.2.3 Access roads

There are two primary access roads within the project area to provide access to the Balranald Project:

- West Balranald access road – a private access road to be constructed from the Balranald Ivanhoe Road to the West Balranald mine.
- Nepean access road – a route comprising private access roads and existing public roads. A private access road would be constructed from the southern end of the West Balranald mine to the Burke and Wills Road. The middle section of the route would be two public roads, Burke and Wills Road and Arumpo Road. A private access road would be constructed from Arumpo Road to the Nepean mine.

The West Balranald access road would be the primary access point to the project area, and would be used by heavy vehicles transporting HMC and ilmenite. The Nepean access road would primarily be used by heavy vehicles transporting ore mined at the Nepean mine to the processing area at the West Balranald mine.

During the initial construction phase, existing access tracks through the project area from the local road network may also be used temporarily until the West Balranald and Nepean access roads and internal access roads within the project are established.

2.2.4 Accommodation facility

An accommodation facility would be constructed for the Balranald Project workforce. It would operate throughout the construction and operation phases of the project. It would be located adjacent to the West Balranald mine near the intersection of the West Balranald access road with the Balranald Ivanhoe Road.

2.2.5 Water supply pipeline

A water supply pipeline would be constructed to supply water from the Murrumbidgee River for operation of the Balranald Project.

2.2.6 Gravel extraction

Gravel would be required during the construction and operational phases of the Balranald Project. Local sources of gravel (borrow pits) have been included in the project area to provide gravel during the construction phase. During the construction phase, gravel would be required for the construction of the West Balranald access road, internal haul roads and service roads, and hardstand areas for infrastructure. Processing operations, such as crushing and screening activities (if required) would also be undertaken at the borrow pits. Gravel for the operational phase would be obtained from external sources.

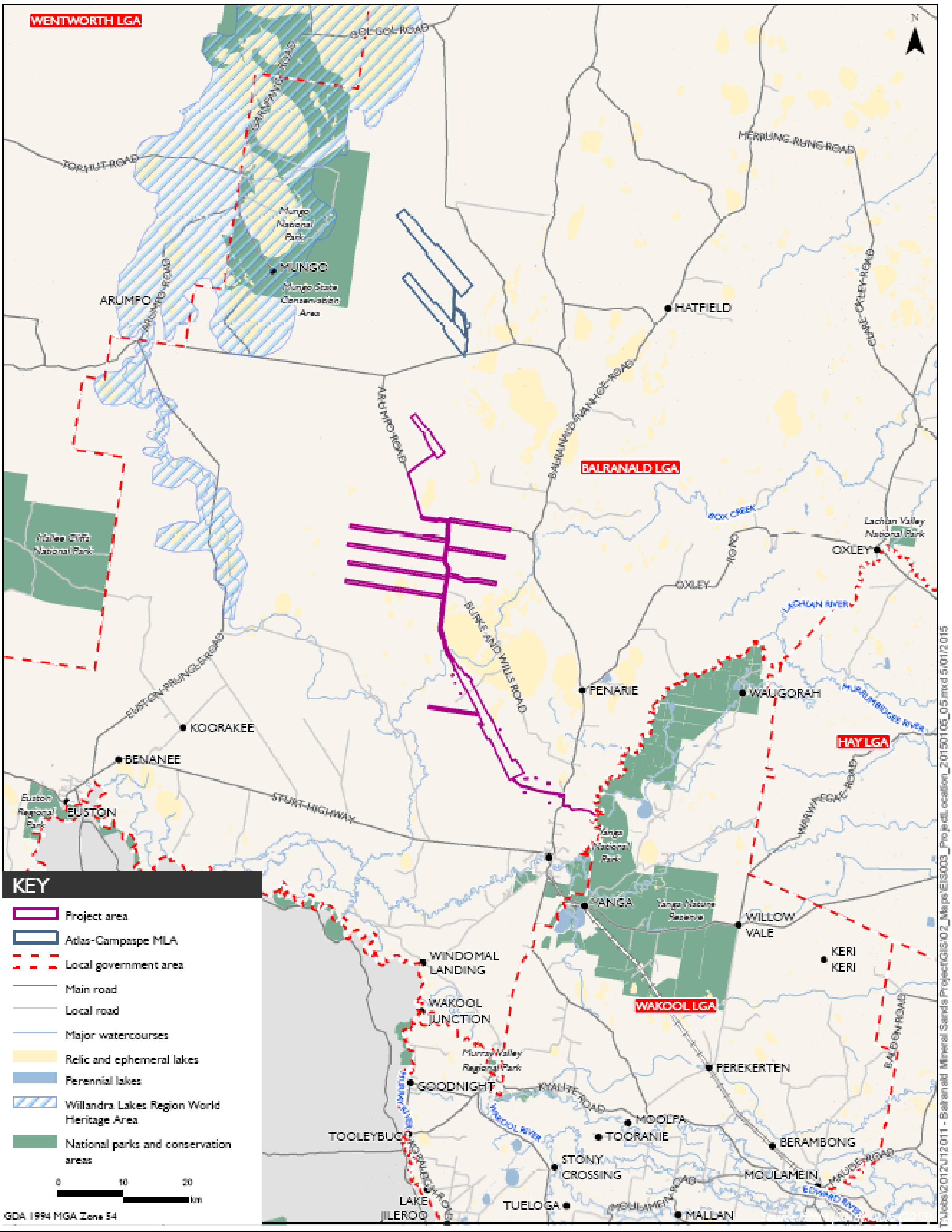

Figure 2. Balranald Project area

3 Local setting

3.1 Land use and topography

Land use in the vicinity of the project area is largely agricultural, including sheep grazing and grain crops. Agricultural land also includes large areas of mallee scrub and saltbush plains. Several conservation areas for mallee vegetation have been established under Western Lands Lease agreements enacted by the Crown under the NSW Western Lands Act 1901 within the project area.

The terrain elevations at the project area vary between 47 m Australian Height Datum (AHD) to 123 m AHD. The higher terrain flanks the north to northwest extent of the Balranald Project with the West Balranald mine located in relatively lower elevations compared to Nepean mine. **Figure 3** presents the topography in the context of the project area.

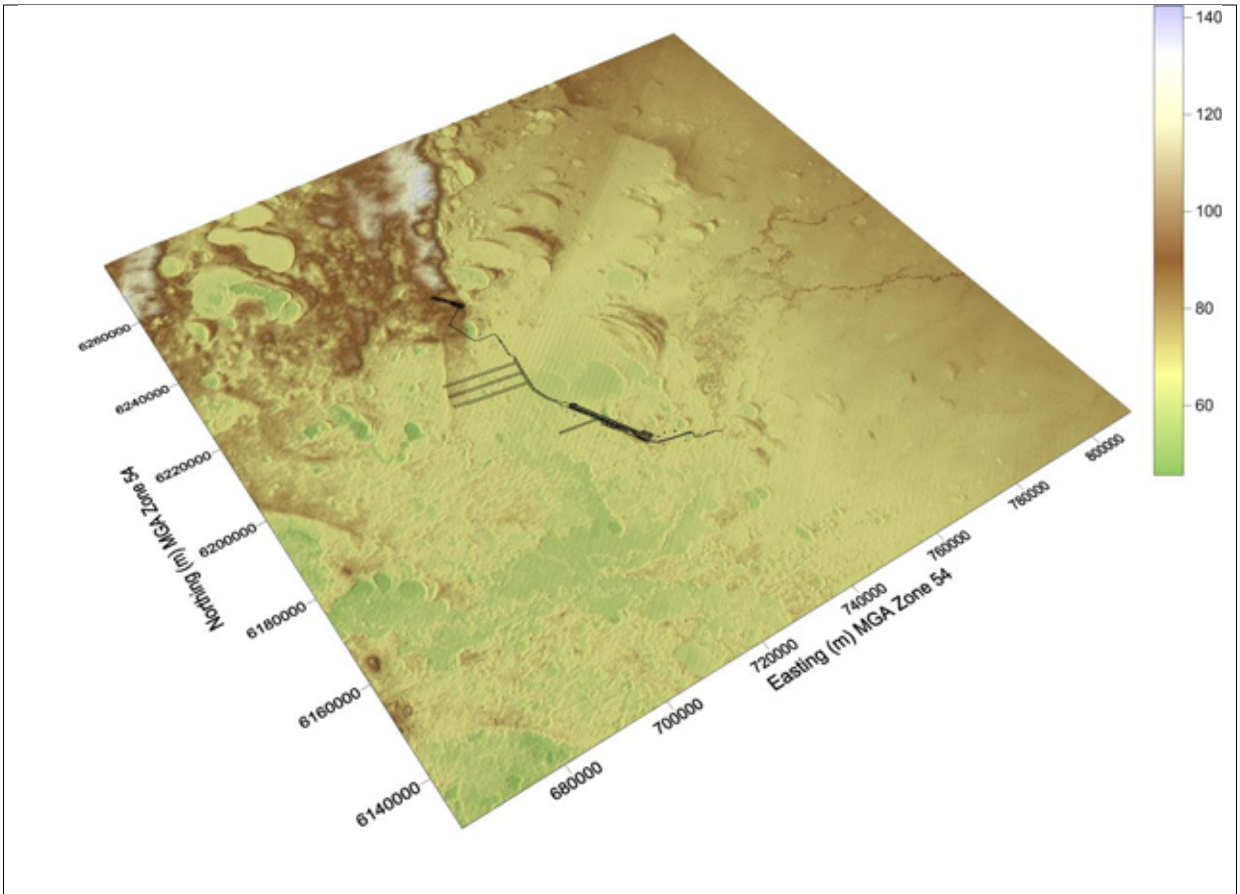

Figure 3. Balranald Regional Topography

3.2 Assessment locations

Land ownership in and near the project area includes Western Lands Lease (WLL), freehold, Crown and other land tenures. Outside Balranald town, properties are typically large rural land holdings, and homesteads and dwellings are sparsely located. Buildings including homesteads/dwellings, sheds, shearers quarters and other outbuildings have been identified by Iluka, largely based on aerial photography interpretation, with ground-truthing of structures closer to the project area.

These are referred to as assessment locations for the purposes of this assessment. Of the 345 assessment locations identified, the presence of habitable structures (ie dwellings) has been ground-truthed in areas closer to the project area.

Air quality impacts from mining operations have been predicted at 345 assessment locations. The dispersion modelling undertaken for assessing the air quality impacts, focuses on an area 80 km wide and 130 km long, centred to cover the West Balranald and Nepean mines (further discussion on the modelling domain is presented in **Section 7.1**).

The locations of the assessment locations identified within the modelling domain are illustrated in **Figure 4** and listed in **Appendix A**.

Figure 4. Assessment locations

4 Air quality assessment criteria

The Balranald Project must demonstrate compliance with the impact assessment criteria outlined in the NSW EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales ("the Approved Methods") (NSW EPA, 2005). The impact assessment criteria are designed to maintain ambient air quality that allows for the adequate protection of human health and well-being.

The emissions to air from the Balranald Project are predominantly from material handling (particulate matter (PM)), the combustion of fossil fuels in mining vehicles and at the mineral processing plant. The following air quality indicators are considered in this report:

- total suspended particulate matter (TSP);
- particulate matter less than 10 microns in aerodynamic diameter (PM_{10});
- particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$);
- dust deposition;
- oxides of nitrogen (NO_x);
- sulphur dioxide (SO_2);
- carbon monoxide (CO);
- respirable crystalline silica (RCS); and
- lead and other trace metals.

The Approved Methods specifies that the impact assessment criteria for 'criteria pollutants[1]' are applied at the nearest existing or likely future off-site assessment location and compared against the 100th percentile (i.e. the highest) dispersion modelling prediction. Both the incremental and cumulative impacts need to be considered (consideration of existing ambient background concentration is required).

The impact assessment criteria for 'air toxics' (see Section 4.4) are applied at and beyond the project area boundary and reported as the 99.9th percentile of the dispersion modelling predictions. Only incremental impacts for these pollutants need be reported.

4.1 Particulate matter

Air quality limits for PM are typically given for various particle size metrics, including TSP, PM_{10} and $PM_{2.5}$. PM_{10} and $PM_{2.5}$ require specific consideration due to their health impact potential.

The impact assessment criteria for TSP and PM_{10} are prescribed in the Approved Methods, however $PM_{2.5}$ is not included. Reference is therefore made to the $PM_{2.5}$ advisory reporting standards issued by the National Environmental Protection Council (NEPC) (NEPC, 2003). The National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM) $PM_{2.5}$ advisory reporting standards were published in 2003 for the purpose of supporting the monitoring and evaluation of ambient $PM_{2.5}$ concentrations ahead of the setting ambient air quality standards for this pollutant.

[1] 'Criteria pollutants' is used to describe air pollutants that are commonly regulated and typically used as indicators for air quality. In the Approved Methods the criteria pollutants are TSP, PM_{10}, NO_2, SO_2, CO, ozone (O_3), deposition dust, hydrogen fluoride and lead.

A review of the AAQ NEPM, completed in 2011, recommended updating the air quality standards (NEPC, 2011). In 2012 the Council of Australian Governments (COAG) identified air quality as an issue of national priority (COAG, 2012), and agreed that its Standing Council on Environment and Water (SCEW) would implement a strategic approach to air quality management in the form of a National Plan for Clean Air. On 29 April 2014, Ministers signalled their intention to vary the AAQ NEPM for particles, to reflect the latest scientific understanding on health risks. An impact statement was published in July 2014 which outlines the options considered in the variation (NEPC, 2014). In summary the variation seeks to formalise the advisory reporting standards for $PM_{2.5}$ and adopt more stringent standards for PM_{10}.

The NSW EPA's 24-hour PM_{10} assessment criterion of 50 µg/m^3 is numerically identical to the current NEPM air quality standard except that the NEPM standard allows up to five exceedances per year to provide for infrequent bushfire or dust storm incidents. No provision is made for allowable exceedances of the 24-hour PM_{10} criterion within NSW regulation.

The air quality criteria applied for PM in this assessment are presented in **Table 3**.

Table 3 Impact assessment criteria for PM

PM metric	Averaging period	Concentration (µg/m^3)	Reference
TSP	Annual	90	EPA(1)
PM_{10}	24 hour	50	EPA(1)
	24 hour	50(3)	NEPM(2)
	Annual	30	EPA(1)
$PM_{2.5}$	24 hour	25	NEPM(2)
	Annual	8	NEPM(2)

Note:

1) NSW EPA, 2005 Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales
2) NEPC, 2003, National Environment Protection (Ambient Air Quality) Measure, as amended
3) Provision made for up to five exceedances of the limit per year

4.2 Dust deposition criteria

The NSW EPA impact assessment criteria for dust deposition are summarised in **Table 4**, illustrating the maximum increase and total dust deposition rates which would be acceptable so that dust nuisance could be avoided. Cumulative annual average dust deposition rates within residential areas, which are in excess of 4 g/m²/month, are generally considered to indicate that nuisance dust impacts may occur.

Table 4. Dust deposition criteria

Pollutant	Maximum Increase in Dust Deposition	Maximum Total Dust Deposition Level
Deposited dust (assessed as insoluble solids)	2 g/m^2/month	4 g/m^2/month
Source: *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC 2005)		

4.3 Voluntary land acquisition and mitigation policy

In December 2014, the NSW Department of Planning and Environment (DPE) released their Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments (the VLAMP)[2]. The VLAMP describes the voluntary mitigation and land acquisition policy to address dust (and noise) impacts and outlines mitigation and acquisition criteria for particulate matter.

Essentially, the VLAMP formalises the acquisition criteria than have previously been outlined in conditions of approval for major mining and extractive industries. Under the VLAMP, if an applicant cannot comply with the relevant impact assessment criteria, or if the mitigation or acquisition criteria may be exceeded, the applicant should consider a negotiated agreement with the affected landowner or acquired the land. In doing so, the land is then no longer subject to the impact assessment, mitigation or acquisition criteria, although provisions do apply of “use of the acquired land”, primarily related to protecting existing or prospective tenants.

Voluntary mitigation rights apply when a development contributes to exceedances of the criteria set out in **Table 5** and voluntary acquisition rights apply when a development contributes to exceedances of the criteria set out in **Table 6**. The criteria for voluntary mitigation and acquisition are the same, with the exception of the number of allowable days above short-term impact assessment criteria for PM_{10}, which is zero for mitigation and five for acquisition.

The criteria are the same as they are designed for the projection of human health and essentially provide the land owner with the option for either mitigation or acquisition.

2 http://www.planning.nsw.gov.au/Portals/0/DevelopmentProposals/IMP%20Voluntary%20Land%20Acquisition%20and%20Mitigation%20Policy%20SSD%20Mining.pdf

Table 5 Particulate matter mitigation criteria

Pollutant	Averaging period	Mitigation Criterion		Impact Type
PM_{10}	24 hour	50 µg/m^3 *		Human Health
	Annual	30 µg/m^3 **		Human Health
TSP	Annual	90 µg/m^3 **		Amenity
Deposited Dust	Annual	2 g/m^2/month *	4 g/m^2/month **	Amenity

Note: * Incremental increase due to development alone, with zero allowable exceedances over the life of the development
** Cumulative impact due to the development plus background from other sources.

Table 6 Particulate matter aquisition criteria

Pollutant	Averaging period	Acquisition Criterion		Impact Type
PM_{10}	24 hour	50 µg/m^3 *		Human Health
	Annual	30 µg/m^3 **		Human Health
TSP	Annual	90 µg/m^3 **		Amenity
Deposited Dust	Annual	2 g/m^2/month *	4 g/m^2/month **	Amenity

Note: * Incremental increase due to development alone, with up to 5 allowable exceedances over the life of the development
** Cumulative impact due to the development plus background from other sources.

4.4 Products of combustion

The combustion of diesel in mining equipment and LPG at the processing plant will result in combustion-related emissions including NO_2, SO_2, CO and volatile organic compounds (VOCs). The impact assessment criteria for are summarised in **Table 7**. While many VOC species are emitted from combustion of fossil fuels, benzene and PAHs are shown as they are amount the most stringent of the impact assessment criteria for organic species.

Table 7: Criteria for gaseous air pollutants

Pollutant	Averaging period	Concentration		Reference
		µg/m³ [1]	pphm[2]	
NO_2	1-hour	246	12	NSW EPA[3]
	Annual	62	3	NSW EPA[3]
SO_2	1-hour	570	20	NSW EPA[3]
	24-hour	228	8	NSW EPA[3]
	Annual	60	2	NSW EPA[3]
CO	1-hour	30,000	2,500	NSW EPA[3]
	8-hour	10,000	900	NSW EPA[3]
Benzene	1-hour	29	0.9	NSW EPA[3,4,5]
PAHs (as BaP)	1-hour	0.4	-	NSW EPA

Note 1: Gas volumes expressed at 0°C and 1 atmosphere, except benzene which is expressed at 25°C

Note 2: pphm – parts per hundred million

Note 3: *Approved Methods for Modelling*

Note 4: For a Level 2 Assessment (defined within the *Approved Methods for Modelling*), expressed as the 99.9th Percentile Value. The current assessment constitutes a Level 2 Assessment

Note 5: Assessment criteria specified for toxic air pollutant

4.5 Trace metals

The various materials handled at the Balranald Project site (topsoil, subsoil, overburden, ore and tailings) contain trace metals, some of which are toxic. Extraction, handling and processing of these materials may release trace amounts of fugitive emissions. Toxic air pollutants are classified in the Approved Methods into two categories: principal toxic air pollutants and other individual air toxic pollutants. Principal toxic air pollutants are further classified based on their carcinogenic and toxic properties (International Agency for Research on Cancer (IARC) Group 2A, 2B and B1) as detailed in **Table 8**. The impact assessment criteria documented in this table are applicable for the assessment of incremental (Project-related) concentrations.

Table 8. Criteria for toxic air pollutants[3]

Pollutant	Principal/ Individual	Averaging Period	Concentration		Reference
			µg/m³	pphm	
Antimony and compounds	Individual	1-hour	9	N/A	EPA[(1)]
Arsenic and compounds	Principal	1-hour	0.09	N/A	EPA[(1),(2)]
Barium	Individual	1-hour	9	N/A	EPA[(1)]
Beryllium and compounds	Principal	1-hour	0.004	N/A	EPA[(1),(2)]
Cadmium and compounds	Principal	1-hour	0.018	N/A	EPA[(1),(2)]
Chromium III compounds	Individual	1-hour	9	N/A	EPA[(1)]
Chromium VI compounds	Principal	1-hour	0.09	N/A	EPA[(1),(2)]
Copper fumes	Individual	1-hour	18	N/A	EPA[(1)]
Iron oxide fumes	Individual	1-hour	90	N/A	EPA[(1)]
Magnesium oxide fumes	Individual	1-hour	180	N/A	EPA[(1)]
Manganese and compounds	Individual	1-hour	18	N/A	EPA[(1)]
Mercury organic	Individual	1-hour	0.18	N/A	EPA[(1)]
Nickel and compounds	Principal	1-hour	0.18	0.009	EPA[(1),(2)]
Silver metal	Individual	1-hour	1.8	N/A	EPA[(1)]
Zinc chloride fumes	Individual	1-hour	18	N/A	EPA[(1)]

Note 1: *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC 2005)

Note 2: IARC Group 1 carcinogen (known human carcinogen).

Note 3: For a Level 2 Assessment (defined within the Approved Methods for Modelling), expressed as the 99.9th Percentile Value. The current assessment constitutes a Level 2 Assessment

The impact assessment criterion for lead is presented in **Table 9** and is applicable at the nearest sensitive receptor. In assessing against these criteria, the total air pollutant concentration (incremental plus background concentration) must be reported as the 100th percentile in concentration units consistent with the impact assessment criteria and compared with the relevant impact assessment criteria.

Table 9. Criteria for lead

Pollutant	Averaging Period	Concentration (µg/m3)	Reference
Lead	Annual	0.5	EPA(1)

Note 1: *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC 2005)

4.6 Respirable crystalline silica

The most common form of crystalline silica is quartz, which is a basic component of sand, stone, granite and many other minerals (United States Branch of Industrial Minerals, 1992).

Inhalation of RCS particles has long been known to cause silicosis, an inflammation and scarring in the lungs reducing the capacity to absorb oxygen from air depending on the level of exposure. IARC has classified crystalline silica as a human carcinogen[3].

Australia has industrial exposure criteria, limiting the allowable concentration of crystalline silica in the workplace environment. However, there are no national or NSW limits for crystalline silica in the ambient air. Several jurisdictions in the US have ambient air quality standards limiting the presence of crystalline silica in ambient air. In 2005, the California Office of Environmental Health Hazard Assessment (OEHHA) adopted a chronic Reference Exposure Level (REL) for respirable crystalline silica of 3 µg/m^3 (measured as PM_4). A chronic REL is defined as “an airborne level of a chemical at or below which no adverse health effects are anticipated in individuals indefinitely exposed to that level” and is assessed as an annual average. Victoria has developed an assessment criteria based on California regulations for RCS of 3 µg/m^3 for mining and extractive industries[(4)]. The Victorian criterion represents an annual average criterion applied to RCS in the $PM_{2.5}$ fraction.

In the current assessment, reference was made to the Victorian annual average criterion of 3 µg/m^3. This criterion is applicable for evaluating cumulative RCS levels (project plus background).

[3] US Department of Health and Human Services, National Toxicology Program, 12th Report on Carcinogens accessed 19/12/2012 http://ntp.niehs.nih.gov/ntp/roc/twelfth/profiles/Silica.pdf

[4] Victoria State Environment Protection Policy (Air Quality Management) for Mining and Extractive Industries (EPA 2007)

4.7 In-stack concentration limits

The mineral processing plant, located at the West Balranald mine, is required to meet standards of concentration set out in the Protection of the Environment Operations (Clean Air) Regulation 2010.

The Clean Air Regulation sets standards for various activities and those that are applicable to the Balranald Project are outlined in **Table 10**.

Table 10. POEO Clean Air Regulation standards of concentration

Pollutant	Standard (mg/Nm^3)	Source	Activity
Solid particles	50	Schedule 4 - General standards of concentration	Any activity or plant
NO_x	350		Any activity or plant (except boilers, gas turbines and stationary reciprocating internal combustion engines)

Note 1: *Reference conditions defined as dry, 273 K, 101.3 kPa and 3% O2.*

5 Climate and meteorology

Meteorological mechanisms govern the generation, dispersion, transformation and eventual removal of pollutants from the atmosphere. Air dispersion comprises vertical and horizontal components of motion. The stability of the atmosphere and the depth of the surface-mixing layer define the vertical component. The horizontal dispersion of pollution is primarily a function of the wind field. The wind speed determines both the distance of downwind transport and the rate of dilution because of plume 'stretching'. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness. The wind direction, and the variability in wind direction, determines the general path pollutants will follow, and the extent of crosswind spreading. Airborne particulate concentration levels therefore fluctuate in response to changes in atmospheric stability, to concurrent variations in the mixing depth, and to shifts in the wind field (Oke 2003; Sturman and Tapper 2006).

To adequately characterise the dispersion meteorology of a region, information is needed on the prevailing wind regime, ambient temperature, rainfall, relative humidity, mixing depth and atmospheric stability. Climate and meteorological data sets available for the region are documented in **Section 4.1**. Site-specific meteorological monitoring data are not available for the project area. Accordingly, site-representative hourly meteorology was derived through meteorological modelling. Further information on this modelling is given in **Section 4.2** and in **Appendix B**. A discussion of the wind field, ambient temperature, rainfall, atmospheric stability and mixing depth characteristics of the project area is given in subsequent sections.

5.1 Climate records and meteorological data

The following datasets were used to develop an understanding of the local meteorology.

- Climate statistics were obtained from the Bureau of Meteorology (BoM) Balranald RSL (Station number 49002) and Mildura Airport Automatic Weather Stations (AWS) (Station number 76031).

- Hourly meteorological data were obtained from the following BoM AWS:

  - Mildura Airport (Station number 76031)
  - Swan Hill Aerodrome (AWS number 77094)
  - Ivanhoe Aerodrome (AWS number 49000)
  - Walpeup Research (AWS number 76064) and
  - Hay Airport (AWS number 75019)

Details of these monitoring stations are presented in **Table 11** with the locations of these stations illustrated in **Figure 5**.

Table 11 Details of the meteorological monitoring sites referenced in the study

Station Name	Easting	Northing	Distance (km) / Direction from Project Area[1]	Elevation (m, AHD)
Balranald RSL	734650	6163896	6 / SSE	61
Mildura Airport AWS	600078	6211164	140 / WNW	50
Swan Hill Aerodrome	730882	608222	88 / S	71
Ivanhoe Aerodrome	809572	6356816	200 / NNE	100
Walpeup Research	591483	6113176	155 / SW	105
Hay Airport AWS	851940	6171150	118 / E	93

Note:

1) Distance calculated from southern-most extent of project area

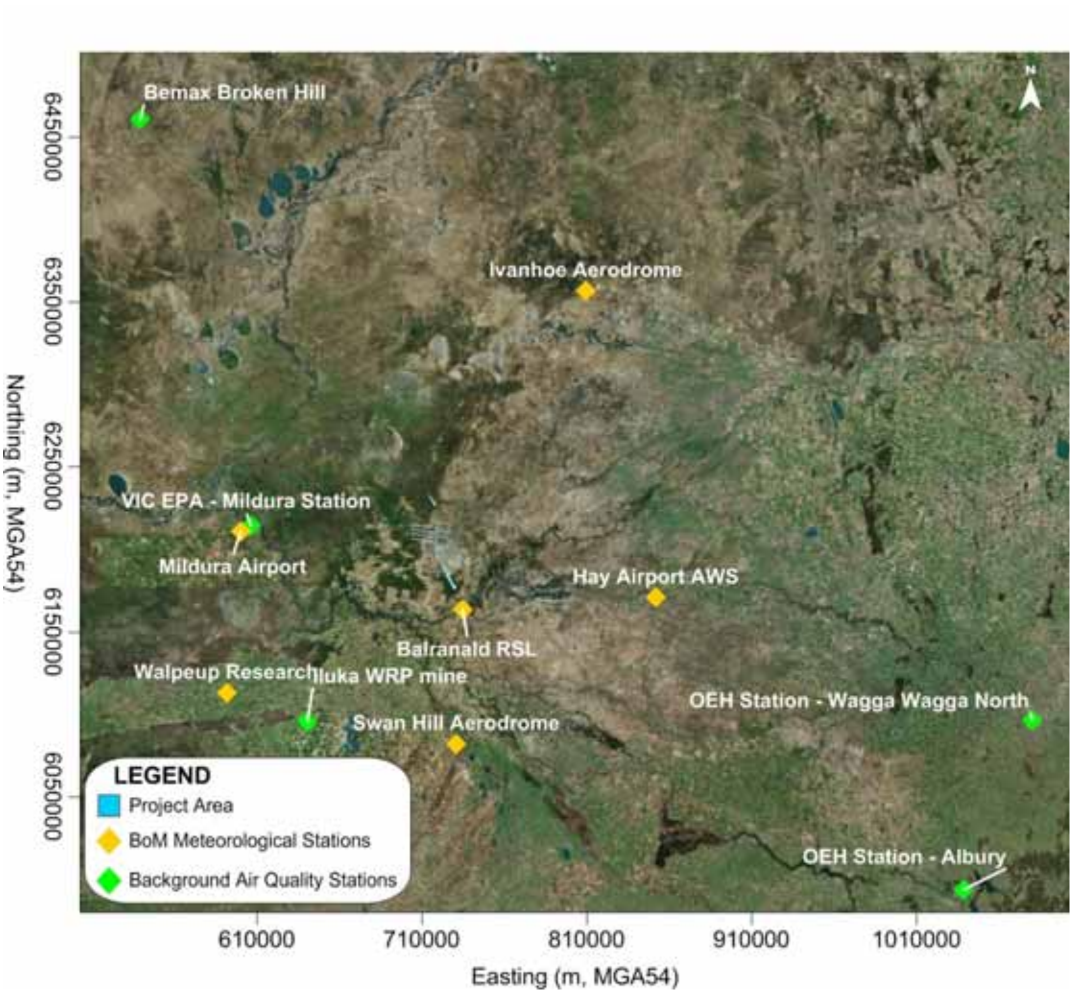

Figure 5. Regional meteorological and air quality stations

5.2 Meteorological modelling

The Approved Methods requires that a Level 2 impact assessment be conducted using at least one year (90% complete) of site-specific hourly meteorological data. If site-specific meteorological data are not available, the Approved Methods advises that a meteorological model be generated using a prognostic meteorological model such The Air Pollution Model (TAPM) developed by Commonwealth Scientific and Industrial Research Organisation (CSIRO).

No site-specific monitoring data are available for the Balranald Project and therefore meteorological modelling was used to generate an input file to drive the dispersion model.

Iterative modelling was conducted to identify the most suitable modelling method. The final modelling approach comprised of a combination of prognostic data generated by TAPM with hourly observations from the closest BoM AWS at Mildura Airport used as input into a regional diagnostic CALMET model. This method is known as the 'CALMET Hybrid mode', as defined in the CALPUFF modelling guidance developed for the NSW EPA (**TRC, 2011**).

Wind field data from CALMET were output for three locations within the project area to assess spatial variations in the wind field, corresponding to the middle of the Nepean mine, the middle of West Balranald mine and midway between Nepean and West Balranald mines. Spatial variations in the wind field were found to be negligible over the project area, expected due to the uniform terrain shown in **Figure 3**.

The CALMET modelling was undertaken for the 2011 calendar year, with the meteorological data set output for the central location between the Nepean and West Balranald mines being used within the USEPA regulatory AERMOD dispersion model. This meteorological data is used in subsequent subsections to describe the meso-scale meteorology for the area.

Further information on the modelling method is given in **Appendix B**.

5.3 Prevailing wind regime

A wind rose of wind speed and direction for 2011 is presented in **Figure 6**. The wind field is dominated by flow from the southern quadrant. Stronger, less frequent westerly and north-northeasterly components are also evident. The average wind speed predicted for 2011 is 3.3m/s, while the percentage of calm periods (wind speeds less than 0.5m/s) is 4.1%.

Seasonal and diurnal wind roses are presented in **Appendix C**. The region experiences higher frequency of calms during autumn and winter. Winds are predominantly south-easterly to south-westerly in summer and autumn while more south-southwesterly to northerly winds are dominant during winter. West-southwesterly to southerly flows are dominant in spring.

Diurnal wind roses were generated by season for four time periods across the day: 12am to 5am, 6am to 11am, 12pm to 5pm and 6pm to 11pm (**Appendix C**). The highest frequency of calms occurs during evenings and nights (6.6% and 5.7% respectively). Relatively lower calms and higher average winds are recorded during day time hours.

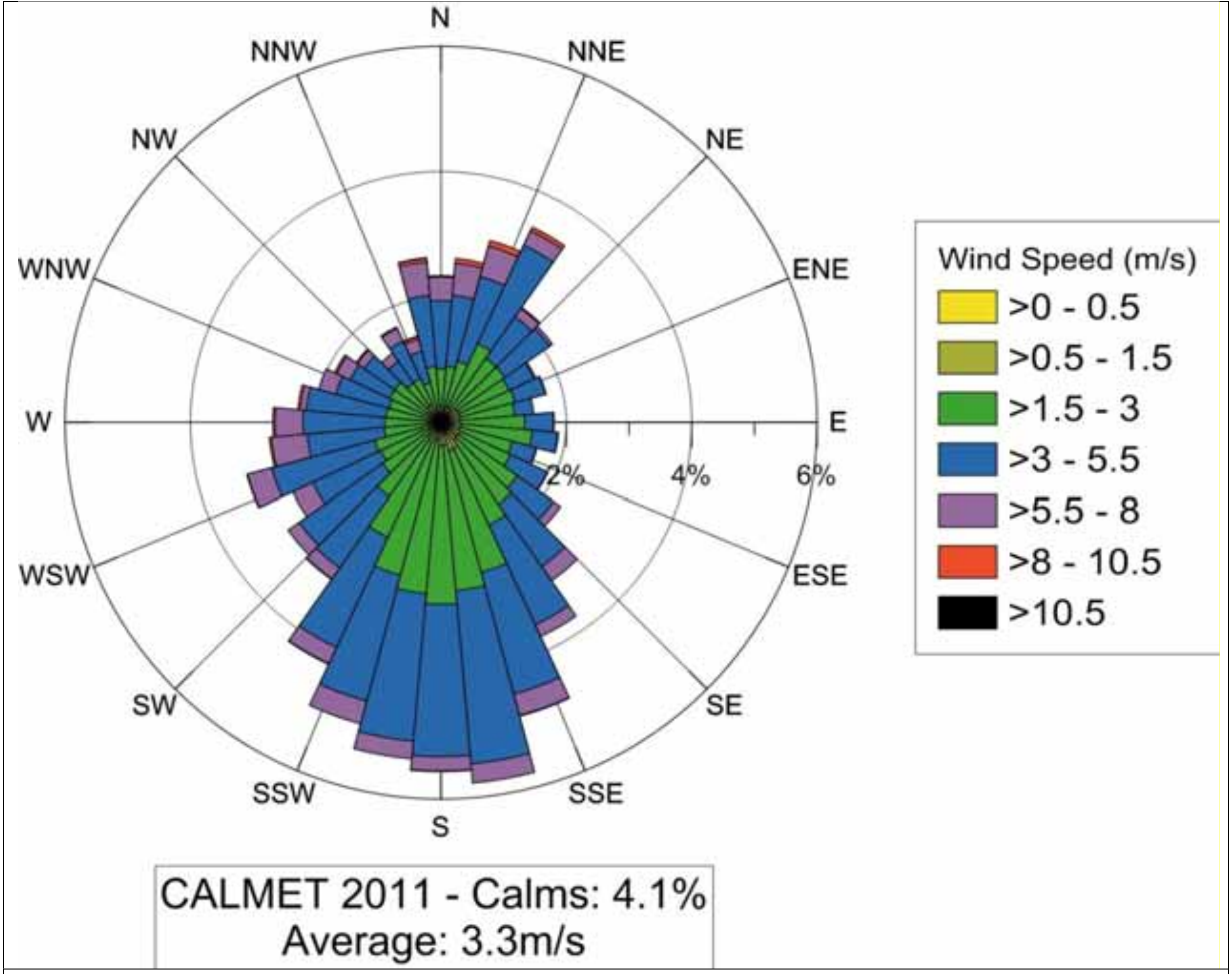

Figure 6. Annual wind rose for the project area – 2011

5.4 Ambient temperature

Air temperature influences plume buoyancy and affects the development of mixing and inversion layers. According to the BoM's 'Australian Climate Zones based on temperature and humidity', the Balranald Project site is located in a zone characterised by hot dry summer and cold winter (**BoM, 2013**).

Monthly mean minimum temperatures are in the range of 3.5°C to 16.4°C, with mean maxima of 16°C to 33°C, based on the long-term average record. Peaks occur during summer months with the highest temperatures typically being recorded between November and February. The lowest temperatures are usually experienced between June and August.

The predicted temperature for the project areas site for 2011 has been compared with long-term trends recorded at the BoM Balranald RSL climate station to determine the representativeness of the dataset. **Figure 7** presents the monthly variation in predicted temperature during 2011 compared with the regional mean, minimum and maximum temperatures recorded at the BoM Balranald RSL climate station. There is good agreement between temperatures predicted and the recorded historical trends.

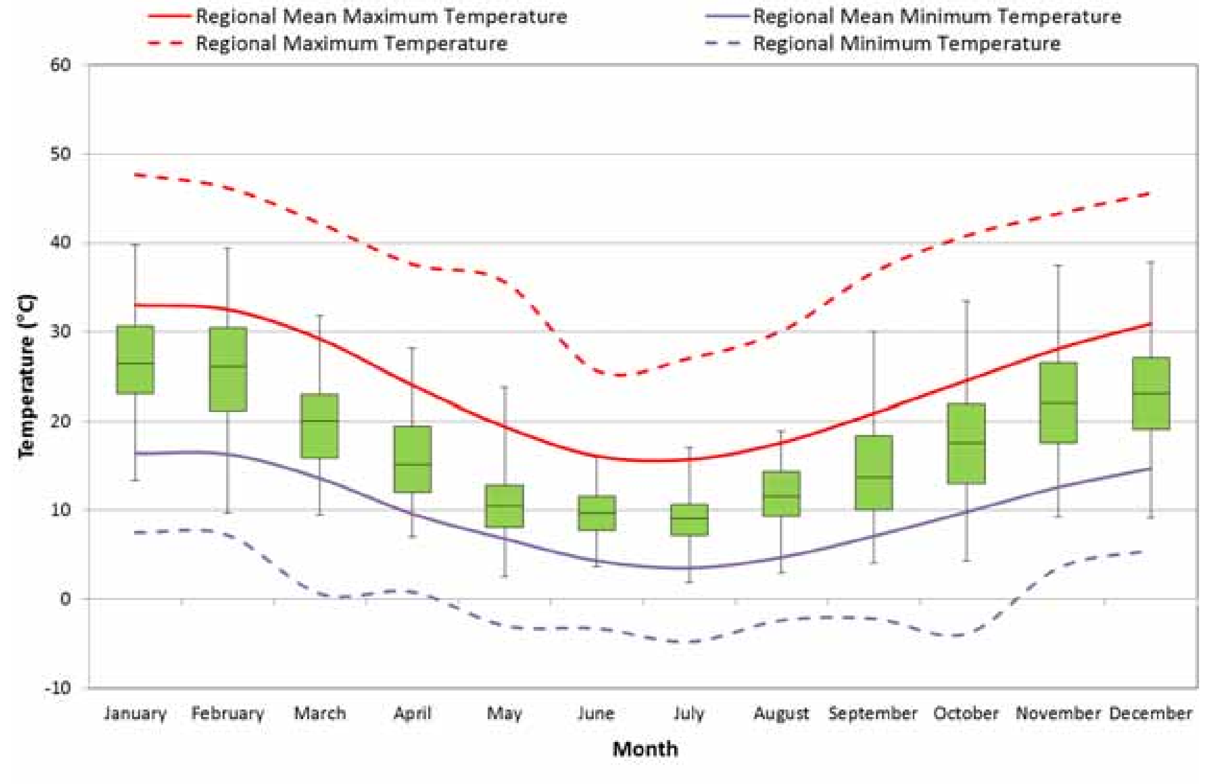

Figure 7. Comparison between 2011 CALMET prediction and long-term average temperature

Box and whisker plots illustrate temperatures predicted by CALMET at Balranald. Boxes indicate 25th, median and 75th percentile temperature predictions while upper and lower whiskers indicate maximum and minimum values respectively. Measured long-term maximum and minimum temperatures are represented as line graphs.

5.5 Rainfall and evaporation

Precipitation is important in air pollution studies since it influences dust generation potential and represents a removal mechanism of atmospheric pollutants. BoM (2013) classifies the region as a *Winter* rainfall zone, with a wet winter and low summer rainfall. Based on historical data recorded (1879-2012) at the BoM Balranald RSL climate station (**Figure 8**), the region is characterised by low rainfall with a long-term average annual rainfall of 324mm, and ranges in annual rainfall between 120mm and 690mm. Rainfall is typically higher between May and October, while the number of rain days per month ranges between 3 and 8 days.

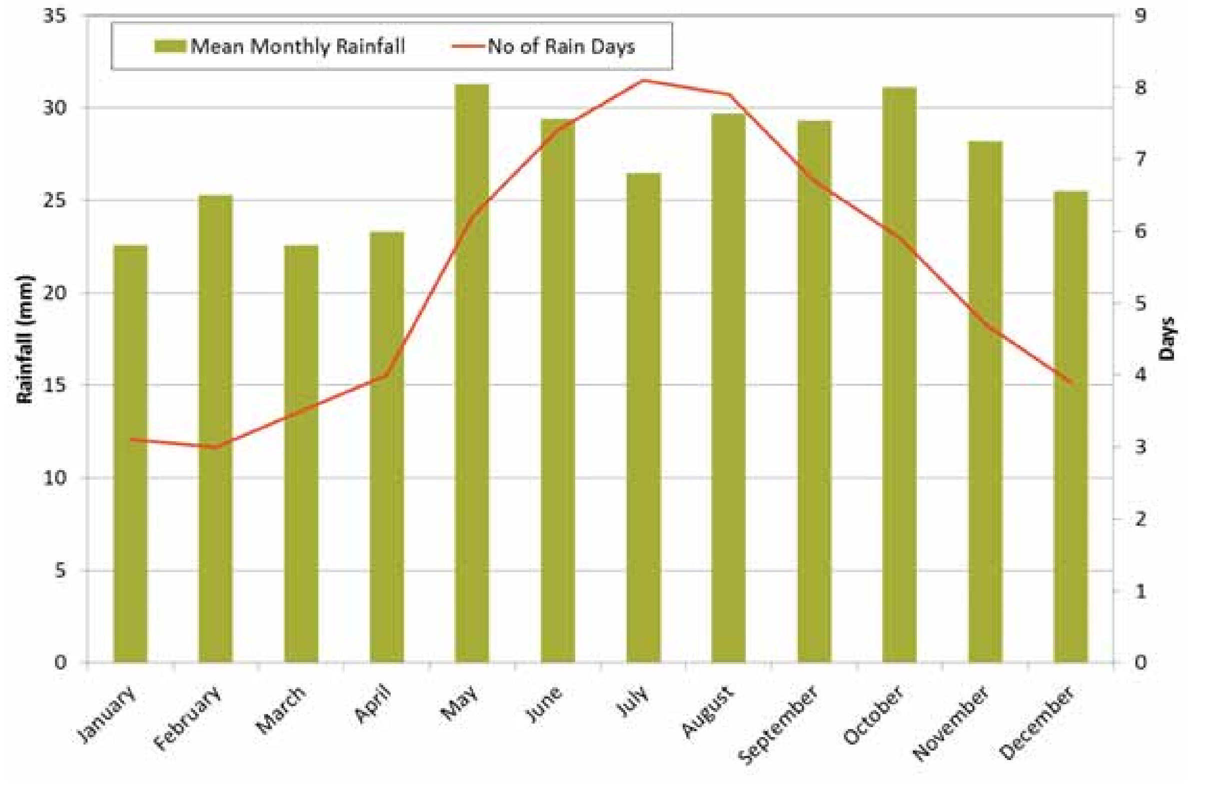

Figure 8. Long-term rainfall trends at Balranald RSL

Evaporation is a function of ambient temperature, wind and the saturation deficit of the air. Evaporation data is not recorded at the BoM Balranald RSL climate station. The closest BoM evaporation monitoring location is at the Mildura Airport AWS. Evaporation data from this location has been paired with rainfall data from the Balranald RSL climate station to analyse the typical moisture deficit for the region. It is noted that mean annual rainfall at Mildura Airport is approximately 290mm, which is comparable to the rainfall experienced at Balranald RSL.

Monthly variation in calculated moisture deficit is illustrated in **Figure 9**. The moisture balance analysis indicates that the region experiences a moisture deficit throughout the year, with evaporation exceeding rainfall for all months. The moisture deficit experienced during the summer months in particular increases the dust erosion potential for exposed areas and stockpiles and therefore has implications for fugitive dust control.

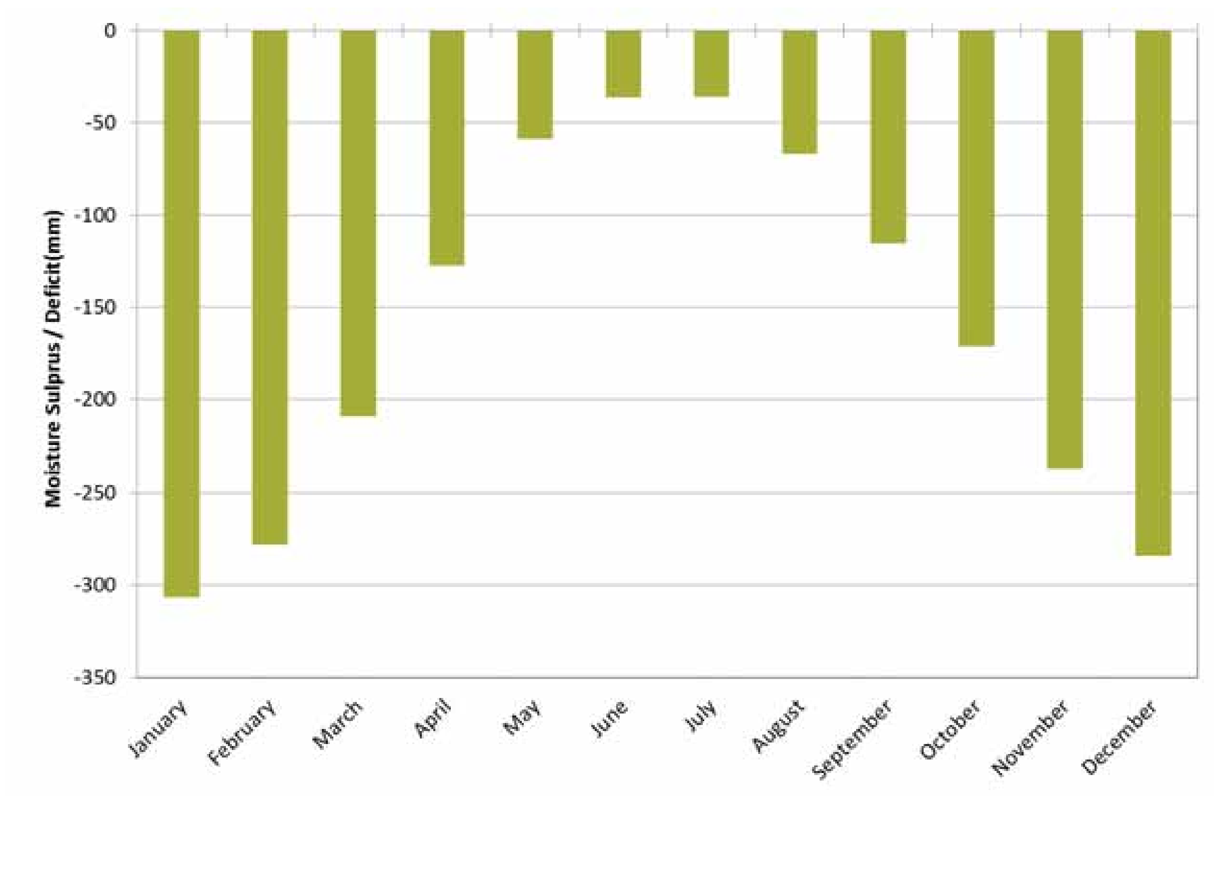

Figure 9. Monthly variation in moisture deficit based on rainfall and evaporation measurements from Mildura Airport AWS (1965 - 2012)

5.6 Atmospheric stability and boundary layer depth

The atmospheric boundary layer constitutes the first few hundred metres of the atmosphere. This layer is directly affected by the earth's surface, either through the retardation of air flow due to the frictional drag of the earth's surface (mechanical mechanisms), or as result of the heat and moisture exchanges that take place at the surface (convective mixing) (Stull, 1997; Oke, 2003).

During the daytime, the atmospheric boundary layer is characterised by thermal turbulence due to the heating of the earth's surface and the extension of the mixing layer to the lowest elevated subsidence inversion. Elevated inversions may occur for a variety of reasons including anticyclonic subsidence and the passage of frontal systems. Due to radiative flux divergence, nights are typically characterised by weak vertical mixing and the predominance of stable conditions. These conditions are normally associated with low wind speeds and hence lower dilution potentials.

For low-level, non-buoyant, wind independent, continuous sources, the highest ground level air pollution concentrations tend to occur during stable, light wind, night-time conditions with pollutants accumulating close to the source. Air pollution emission sources characteristic of the proposed Balranald Project are mostly low level and wind dependent. Atmospheric conditions conducive to peak ground level concentrations from such sources are more complicated and best characterised through the application of dispersion modelling in which temporal variations in atmospheric conditions and source profiles are adequately represented.

Hourly-varying atmospheric boundary layer depths were generated by AERMET, the meteorological processor for the AERMOD dispersion model (see **Appendix B** for detailed discussion). The variation in average boundary layer depth by hour of the day is illustrated in **Figure 10**. Greater boundary layer depths are experienced during the day time hours, peaking in the mid to late afternoon. Higher day-time wind velocities and the onset of incoming solar radiation increases the amount of mechanical and convective turbulence in the atmosphere respectively. As turbulence increases during the day-time, so does the depth of the boundary layer, contributing to greater mixing depths and potential for atmospheric dispersion of pollutants.

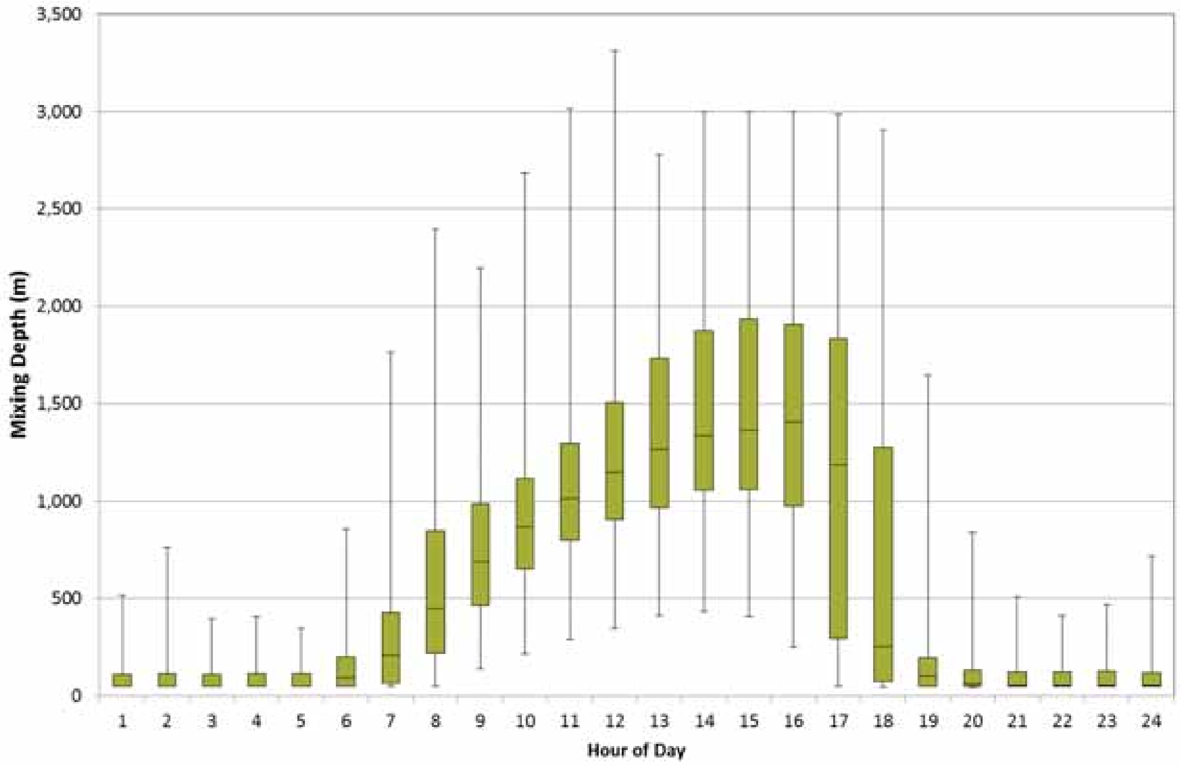

Figure 10: AERMET-generated diurnal variation in average boundary layer depth

Note: Boxes indicate 25th percentile, Median and 75th percentile of AERMET-generated mixing height data while upper and lower whiskers indicate maximum and minimum values.

The Monin-Obukhov length (L) provides a measure of the stability of the surface layer (ie the layer above the ground in which vertical variation of heat and momentum flux is negligible; typically about 10% of the mixing height). Seinfeld and Pandis (2006) provide typical value ranges for L for widely referenced atmospheric stability classes, as listed within **Table 12**.

Table 12. Monin-Obukhov Length with respect to atmospheric stability

Monin-Obukhov Length (L)	Range	Stability Class
Very Large Negative	$L < -10^5$m	Neutral
Large Negative	-10^5m $\leq L \leq$ -100m	Unstable
Small Negative	-100m < L < 0	Very Unstable
Small Positive	0 < L < 100m	Very Stable
Large Positive	100m $\leq L \leq 10^5$m	Stable
Very Large Positive	$L > 10^5$m	Neutral

Source: Table 16.2, Seinfeld and Pandis (2006)

Figure 11 illustrates the diurnal variation of atmospheric stability derived from the Monin-Obukhov length. The diurnal profile presented illustrates that atmospheric instability increases during daylight hours as convective energy increases, whereas stable atmospheric conditions prevail during the night-time. This profile indicates that the potential for atmospheric dispersion of emissions would be greatest during day-time hours and lowest during evening through to early morning hours.

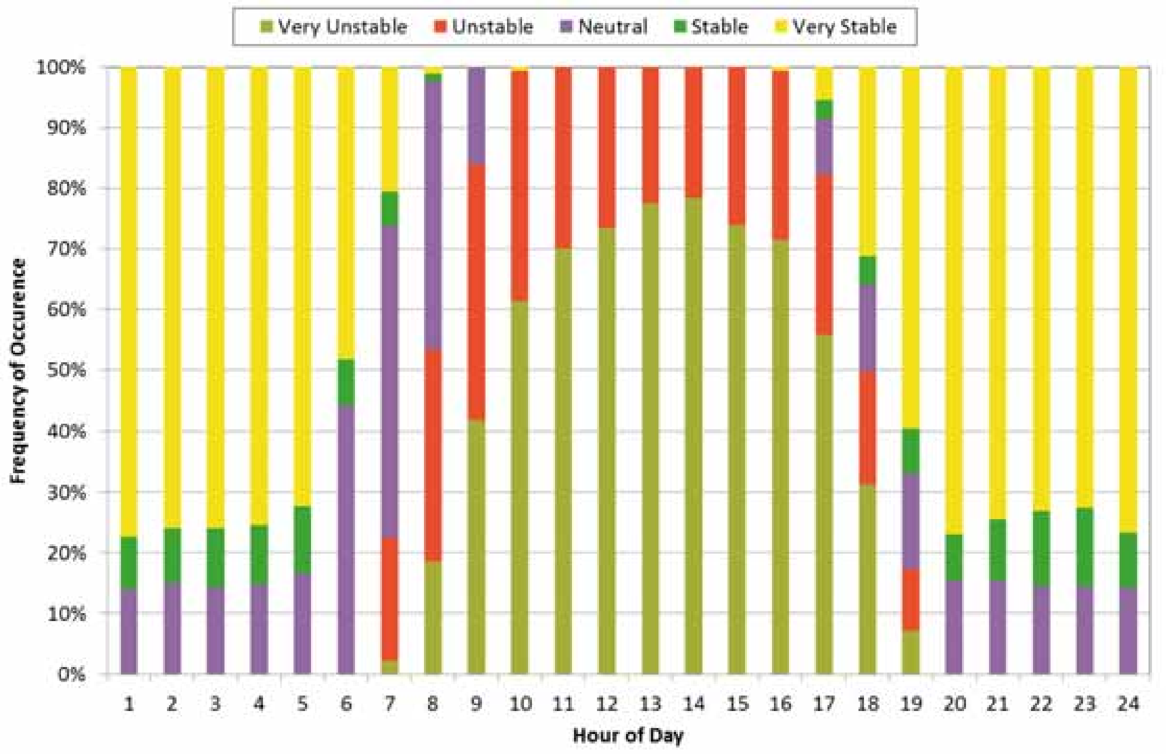

Figure 11. Diurnal variation in derived atmospheric stability

6 Baseline air quality environment

The quantification of cumulative air pollution concentrations and the assessment of compliance with ambient air quality limits necessitate the characterisation of baseline air quality. As particulate matter represents the primary emissions from the Balranald Project, it is pertinent that existing sources and ambient suspended particulate concentrations and dust deposition rates be considered.

6.1 Existing sources of air emissions

The National Pollutant Inventory (NPI) and the NSW EPA POEO public register were reviewed to identify significant existing sources of air pollutants in the surrounding region. Review of the EPA's licensed and un-licensed premises identified four facilities located within 100 km of the project area (from the southernmost extent of the project area) that could contribute towards background air quality in the region (**Table 13**). Andrew Peace Wines, located approximately 56 km from the mine boundary, reports emissions of ethanol and total VOC under the NPI.

Table 13. EPA regulated facilities

Organisation Name	Location	Suburb	Activity	Distance from Project area (km) [2]
Balranald Gypsum Pty Ltd[1]	White Plains Gypsum, Ivanhoe Road	Balranald	Mining for minerals	8
Balranald Gypsum Pty Ltd[1]	Paxtons Mine Lease, Ivanhoe Road	Hatfield	Mining for minerals	90
Balranald Gypsum Pty Ltd[1]	Norm's Mine, Ivanhoe Road	Balranald	Mining for minerals	20
Brendan Patrick Coates[1]	Glen Avon Station, Ivanhoe Road	Balranald	Cattle, sheep or horse accommodation	3

Note:

1) OEH licensed premises
2) Distances are approximate and calculated from the southernmost extent of the project area

Given the rural setting, other potential sources of atmospheric emissions near the project area could include:

- Dust entrainment due to vehicle movements along unsealed roads and sealed roads with high silt loading levels;
- Vehicle exhaust;
- Wind-blown dust from open (scalded or eroded) areas;
- Agricultural activities;
- Episodic emissions from vegetation fires; and
- Frequent dust storms characteristic of the tablelands (further information provided in Section 6.2.1).

6.2 Air quality monitoring data

No site-specific monitoring data are available for the Balranald Project and reference is therefore made to various sources of regional air quality monitoring data, including:

- Regional Dust Storm Index maps.
- Industry monitoring data (PM_{10} and dust deposition) for the Bemax Broken Hill Mineral Separation Plan).
- Industry monitoring data (dust deposition) for Iluka's Woornack, Rownack, and Pirro (WRP) mine located 130 km south-west of Balranald.
- OEH monitoring data at Albury (PM_{10}) and Wagga Wagga (PM_{10} and $PM_{2.5}$).
- Historical monitoring data (PM_{10}) collected by Victoria EPA at Mildura.

6.2.1 Dust Storm Index (DSI)

The Dust Storm Index (DSI) is a continental scale measure of the frequency and intensity of wind erosion activity, based on observations of visibility made at BoM stations. The DSI is used to monitor wind erosion for reporting in National State of the Environment (SoE) reports and for the Australian Rangeland Information System (ACRIS). The ACRIS project commenced in 1992 and recent analysis presents DSI averages for the period 1992 to 2010.

The Balranald Project is located within the Murray Darling Depression region (shown by the number 1 in **Figure 12**) and has an average (1992-2010) DSI of 4.9, indicating a moderate potential for dust storm occurrence which would contribute to background particulate matter concentrations within the region.

The Broken Hill Complex region to the north (shown by number 25) has a slightly higher average (1992-2010) DSI of 6.1.

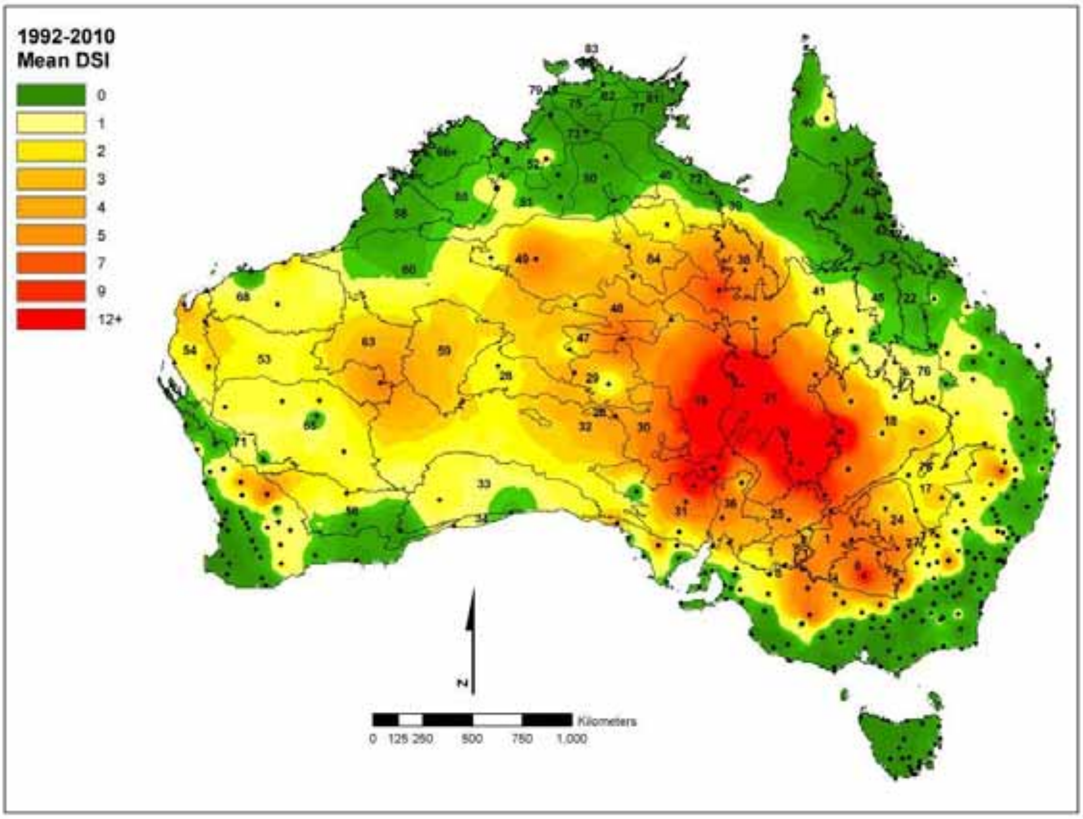

Figure 12. Mean Dust Storm Index 1992 to 2005 – Australia

Source: McTainsh *et al* (2011)

6.2.2 PM_{10} concentrations

The closest available PM_{10} monitoring data to the Balranald Project is the historical Victoria EPA station at Mildura, located approximately 135 km from the southernmost extent of the project area. Monitoring for PM_{10} is also conducted at the Bemax Mineral Separation Plant (MSP) in Broken Hill, approximately 350 km north-west, at the OEH Albury station, approximately 340 km south-east and the OEH Wagga Wagga station, approximately 330 km south-east. The available annual average PM_{10} concentrations recorded at each monitoring site, over the past 10 years, are presented in **Table 14**. Period average PM_{10} concentrations range from 16.7 $\mu g/m^3$ at Albury to 28.0 $\mu g/m^3$ at Mildura.

Data collected at Mildura are limited to 2005 and 2006 and both years have poor data availability (66% and 47%). The monitoring reports published by Victoria EPA do not present monthly maxima or averages for sites were data recovery is less than 75% and for the Mildura site in 2006, the annual average for 2006 is not reported. The Victoria EPA discontinued the site at Mildura and an analysis of other rural monitoring sites in subsequent years indicates that the high PM_{10} concentrations recorded at Mildura, during 2005 and 2006, are not representative of general ambient background for rural areas in Victoria.

The annual average PM_{10} concentrations presented in **Table 14** are influenced by climate conditions. PM_{10} concentrations are higher in 2007, 2008 and 2009 when below average rainfall was recorded across much of the state, corresponding to El Nino conditions / late development of La Nina. In 2010 and 2011 the PM_{10} concentrations are significantly lower, corresponding to development of La Nina conditions resulting in above average rainfall for NSW, including the wettest on record for the Murray-Darling basin (http://www.bom.gov.au/climate/current/statement_archives.shtml).

In 2013 PM_{10} concentrations increase again, corresponding to low rainfall and the warmest year on record for NSW. The period averages (all years) account for climate induced inter annual variability in PM_{10} concentration that might otherwise be missed if a single year is selected. The sites with the most continuous annual PM_{10} data are Broken Hill and Albury. The Broken Hill site is considered to provide a conservatively high estimate of background PM_{10} concentration for the Balranald Project. It is located in a similarly arid area and as indicated in **Section 6.2.1**, the Broken Hill region has a higher DSI than the area around Balranald. An annual average background PM_{10} concentration of 18.0 µg/m^3 is therefore adopted for use in this assessment.

The daily variation in PM_{10} concentrations from 2005 to 2014 are shown in **Figure 13**. It is evident that from early 2010, the 24-hour PM_{10} concentrations are influenced by the transition from El Nino to La Nina in autumn 2010 (shown by the drop in 24-hour PM_{10} concentration. (http://www.bom.gov.au/announcements/media_releases/climate/change/20110105.shtml).

Table 14. Annual average PM_{10} concentratios 2005-2014

Year	Mildura	Broken Hill	Wagga Wagga [3]	Wagga Wagga North	Albury
2005	30	-	24.7	-	16.8
2006	26	-	29.1	-	22.2
2007	-	22.3	26.1	-	20.6
2008	-	26.1	24.7	-	17.4
2009	-	32.3	26.8	-	19.4
2010	-	14.1	17.2	-	12.6
2011	-	12.1	-	-	12.2
2012	-	10.2	-	18.8	14.2
2013	-	14.2	-	22.1	15.8
2014 [2]	-	12.3	-	20.7	16.1
All years	**28.0**	**18.0**	**24.8**	**20.5**	**16.7**

Notes:

1) Averages based on available data, for example, Broken Hill data is based on HVAS measurements every 6th day whereas OEH data is based on continuous monitoring.

2) 2014 averages include data up to December 2014.

3) Wagga Wagga OEH site was discontinued in 2011 and replaced with Wagga Wagga north in 2012.

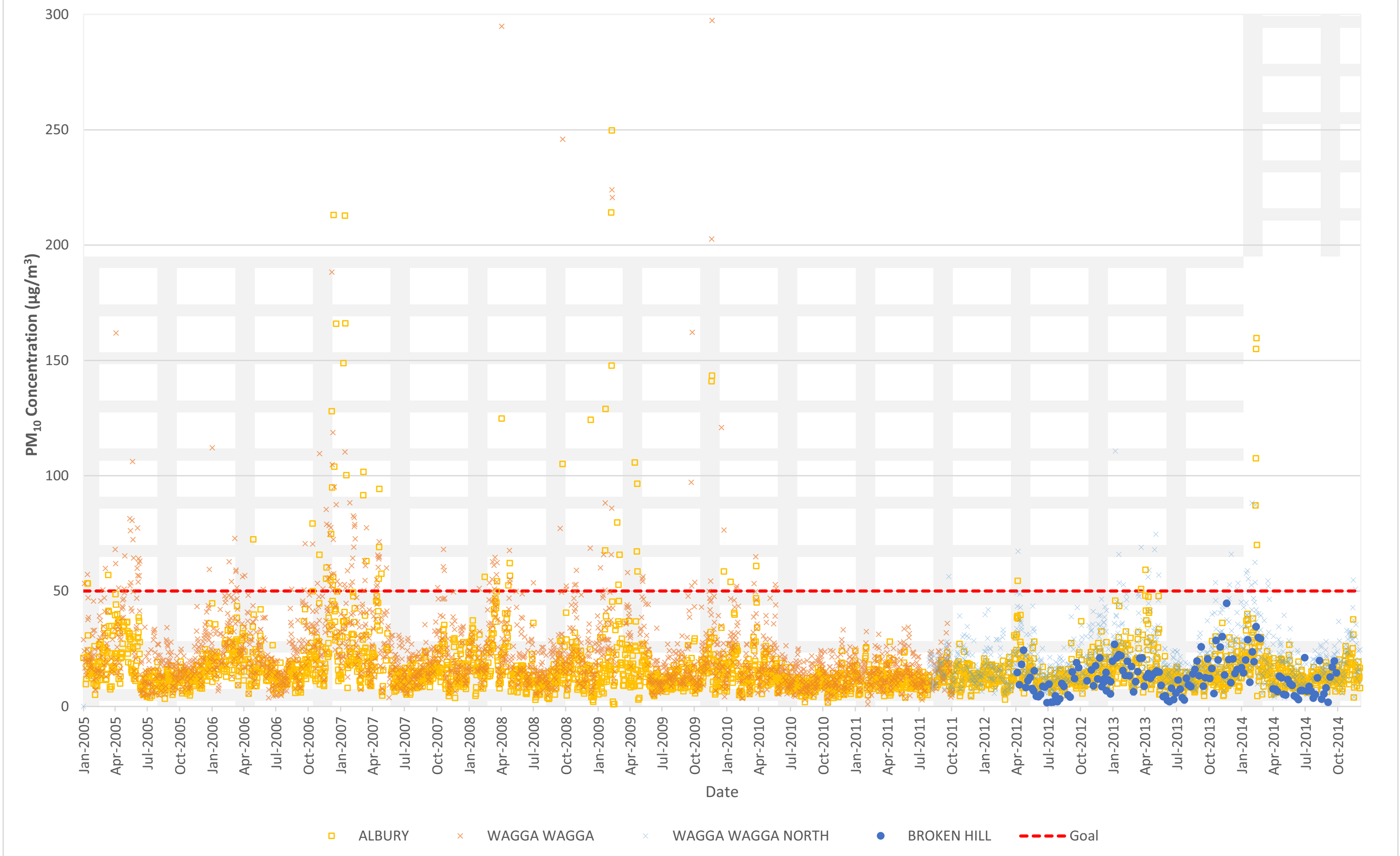

Figure 13. Daily variation in 24-hour average PM10 concentrations

6.2.3 Total suspended particulate matter

Similar to PM_{10}, TSP concentrations are not measured in the vicinity of the Balranald Project. TSP concentrations are measured by CBH Resources at their Rasp Mine in Broken Hill and ENVIRON (2010) presents a PM_{10}/TSP ratio of 0.47, derived from TSP monitoring data for the Rasp Mine and PM_{10} monitoring data for the Bemax MSP. In recent years, CBH Resources have measured both PM_{10} and TSP and the average PM_{10}/TSP ratio for 2010 to 2013 was 0.41 (CBH, 2013).

Applying this ratio to the PM_{10} concentration data for Broken Hill, an annual average TSP concentration of 43.8 µg/m^3 is derived for background, representing approximately 50% of the impact assessment criterion for TSP.

6.2.4 $PM_{2.5}$ concentrations

Limited $PM_{2.5}$ monitoring data are available for rural NSW. OEH currently operate 17 stations where simultaneous concentrations of PM_{10} and $PM_{2.5}$ are recorded. The ratio of $PM_{2.5}$ to PM_{10} at these sites varies from 0.29 to 0.45 (with an average of 0.36).

The ratio is often determined by the dominant source of PM emissions for that locality. For example, in areas with a lot of wood heaters in winter, $PM_{2.5}$ is expected to make up a larger component of PM_{10} (results in a higher ratio). In contrast, an area where crustal dust is expected to dominate (such as Camberwell in the middle of the Hunter Valley), $PM_{2.5}$ is expected to form a smaller proportion of total PM and the ratio is lower.

The area surrounding the Balranald Project is expected to be influenced by PM derived from crustal sources, rather than combustion derived PM, and the $PM_{2.5}/PM_{10}$ ratio would be expected to be in the lower range described above.

However, to provide a more conservative estimate of background $PM_{2.5}$, the average $PM_{2.5}/PM_{10}$ ratio across all OEH monitoring sites is applied to the PM_{10} concentration data for Broken Hill, resulting in an annual average concentration of 6.5 µg/m^3.

6.2.5 Dust deposition

No dust deposition monitoring has been undertaken at the project site, however, data are available for the WRP mine, located 130 km south-west of Balranald. The dust deposition rates at WRP would be indicative of semi-arid areas, although also influenced by dust from the WRP mine operations. Based on data recorded during 2010 and 2011, annual average dust rates vary between 0.5 and 2.1 g/m^2/month across sampling sites, with spatially-averaged annual average dust deposition rates calculated to be 0.8 and 1.5 g/m^2/month for 2010 and 2011 respectively.

A background dust deposition rate of 1.1 g/m^2/month was adopted for use in the cumulative assessment, based on an averaged value over all sampling locations and years.

Table 15. Dust Deposition Rates (g/m²/month), 2010-2011						
Period	**Monitoring Stations**					**Spatial Average**
	KDG01	**KDG02**	**KDG03**	**KDG04**	**KDG05**	
2010	1	0.5	0.9	0.5	1	0.8
2011	2.1	0.5	1.3	1.8	1.8	1.5
Average						1.1

6.2.6 Lead

Background lead concentrations in ambient air have been declining significantly since lead was phased out of petrol in 2002. Lead was previously measured at six sites in NSW, three in the Sydney (the CBD, Earlwood and Rozelle), Port Kembla, Wallsend and Warrawong. These monitoring stations have since been decommissioned and there has been no ambient lead monitoring since 2005 following the significant decrease in lead concentrations.

By 2004, annual average lead concentrations throughout NSW had decreased to typically less than 0.03µg/m³ (well below the criterion of 0.5µg/m³), and many 24-hour average concentrations were below the minimum detection limit (OEH, 2010).

6.2.7 RCS

Ambient RCS levels are not commonly measured and a literature review was undertaken to identify representative background crystalline silica levels. Very little monitoring data are available for ambient RCS concentrations in NSW and no measurements are reported for longer (annual) averaging periods, which would allow comparison against the annual average criterion of 3 µg/m³. Morrison & Nelson (2011) reported ambient RCS levels in the Hunter Valley region in the range 0.2 to 1.4 µg/m³ (for the $PM_{2.5}$ size fraction), based on averaging periods of between one hour and five days. Data collected in Victoria estimated background concentrations of 0.7 µg/m³ (Toxicos, 2005). In California, a value of 0.6 µg/m³ was measured at a rural site and 0.2 µg/m³ at a remote site (OEHHA, 2005).

The annual average background would be expected to be in the in the lower range of these measurements (0.2 µg/m³). However, to be conservative, a value of 0.7 µg/m³ is adopted for cumulative impact assessment, based on measurements obtained in Victoria. This value is close to the mid-range of the short term measurements in NSW.

7 Emissions inventory

7.1 Mine operations and emission scenarios

Land preparation activities ahead of mining will involve vegetation clearing and topsoil stripping. Where possible, land disturbance will be minimised by clearing the smallest practical area of land for the shortest possible time. Stripped soil will be stockpiled adjacent to the pit for use in rehabilitation. Overburden would be both stockpiled adjacent to the pit, and backfilled directly in the mine void. This would depend on the stage of mining operations and material type. At commencement of mining operations with the boxcut, all extracted material would be stockpiled outside of the mine pit. As mining progresses, where possible, overburden would be placed directly into the void behind the advancing pit which would reduce disturbance outside of the pit along the length of the mine.

Run of mine (ROM) ore will be extracted using equipment such as trucks and excavators. Extracted ROM ore will be transported by truck to the ROM stockpile. Front end loaders will feed ore to the dump hopper of the MUP. The MUP screens the ore for oversize material too large for further processing and facilitates the release of mineral sands from clay by the process of scrubbing. The mineral sand slurry is then pumped to the pre-concentrator plant (PCP). The PCP utilises desliming cyclones for fines removal and gravity spirals to concentrate the heavy mineral within the ore. Wet gravity processing methods would separate light minerals (such as quartz) from heavy minerals (such as rutile and zircon), and remove mining by-products such as slimes and sand. The PCP circuit produces a concentrated heavy mineral stream and a sand by-product stream. The concentrated heavy mineral either goes directly to the wet concentrator plant (WCP) as a slurry, or to the decoupling stacker. The sand by-product stream is diverted to a sand tails stacker and stockpiled and placed in the mine void..

The WCP would further upgrade the heavy mineral content of the concentrate stream (from the PCP) to between 95 and 98% heavy mineral. Wet gravity processing methods further separate light and heavy minerals. The WCP employs gravity separation to separate the mineral sand slurry into two streams: fines (clay) and sand fraction. The WCP is typically divided into a primary and secondary concentrating circuit where the primary circuit contains gravity spirals which upgrades the concentrate. The secondary WCP consists of the wet high intensity magnetic separators (WHIMS) circuit and the up-current classifier circuit. The upgraded ore is feed through the WHIMS plant.

The WHIMS plant is a series of high strength magnets which separate magnetic material (ilmenite) from non-magnetic material (HMC). The WHIMS plant is a wet process that splits the product into two streams (HMC product stream and magnetic ilmenite stream) with different destinations and beneficiation process routes.

HMC is stockpiled and trucked offsite for processing at Hamilton, Victoria. The WHIMS magnetic stream processed through an ilmenite separation plant (ISP). The ISP separates the WHIMS magnetic stream from the WCP into two saleable ilmenite products; sulphate and chloride ilmenite. The ISP would include a stockpile reclaim system to feed the ISP, a wash plant to remove dissolved salts from the mineral surfaces and a dry separation plant comprising rare earth drum roll magnetic separators to magnetically fractionate the mineral.

The sulphate and chloride ilmenite product streams would be stockpiled in the processing area. Dust extraction technology will be provided at all mineral separation points, product collection boxes, overflow and product bins and each separator of the dry separation plant. The dust extraction system will be vented through a baghouse stack. Further details on stack parameters are presented in **Section 7.5**.

Emissions inventories have been developed for three representative years during mining operations, selected to assess the air quality impacts of worst-case operations, for example where material movement is highest, where extraction or wind erosion areas are largest, or where operations are located closest to receivers, as follows:

- Year 1: Commencement of mining operations at the West Balranald mine, including development of the initial box cut. Mining operations are located close to a cluster of assessment locations to the east.
- Year 4: Mining the West Balranald mine at highest ore extraction. Closest mining operations to the closest assessment location to the west.
- Year 8: Mining the Nepean mine at highest material movement with concurrent mining operations at the West Balranald mine.

Production data and mine plans for each modelled year during mining operations were provided by Iluka.

The volume of material handled is presented in **Table 16**. Although Year 5 has the greatest amount of material moved at the West Balranald mine, Year 4 has more out of pit material movement and was therefore selected as a worst case emission scenario. For Year 8, the material movement volumes for Year 7 (**Table 16**) were adopted as these present the greatest volume of material moved at the Nepean mine.

Table 16. Total material handled by year (Mbcm[1])

Year	West Balranald	Nepean
Year 1	36.8 [2]	-
Year 2	44.4	-
Year 3	41.2	-
Year 4	43.0	-
Year 5	50.6	-
Year 6	39.3	4.1
Year 7	6.0	31.0
Year 8	4.8	13.5

Note:
[1] Mbcm = Million bank cubic meters
[2] includes boxcut material

Emission factors developed by the US EPA[5], have been applied to estimate the amount of dust produced by each activity (material handling, wind erosion, hauling). Emissions are quantified for total (TSP), coarse (PM_{10}) and fine PM ($PM_{2.5}$) and are summarised in Table 17, Table 18 and Table 19.

Further details on the emission inventory development is provided in **Appendix D**.

[5] United States Environmental Protection Agency (US EPA) AP-42 Compilation of Air Pollutant Emission Factors

Table 17. Estimated emissions (kg/year) - Year 1

Activity	TSP	PM_{10}	$PM_{2.5}$
Soil stripping and re-handling			
Dozer clearing vegetation	2,783	596	292
Scraper stripping soil	28,031	16,819	869
Scraper unload	19,332	11,599	599
Soil re-handle (excavator to truck)	720	341	52
Soil re-handle (haul to pit)	11,005	3,095	309
Soil re-handle (truck unload)	720	341	52
Dozer soil spreading	2,022	433	212
Overburden			
NSOB - dozer in pit	40,245	11,081	4,226
NSOB - excavator loading trucks	3,629	1,717	260
NSOB - haul to direct placement	19,107	5,373	537
NSOB - unload to direct placement	795	376	57
NSOB - haul to stockpile	105,476	29,661	2,966
NSOB - unload to stockpile	4,390	2,076	314
SOB - dozer in pit	94,475	26,013	9,920
SOB - excavator loading trucks	6,342	2,999	454
SOB - haul to direct placement	340,569	95,772	9,577
SOB - unload to direct placement	6,496	3,073	465
SOB - haul to stockpile	537,468	151,142	15,114
SOB - unload to stockpile	2,563	1,212	184
SOB - rehandle - excavator loading trucks	573	271	41
SOB - rehandle - haul to pit	171,711	48,287	4,829
SOB - rehandle - unload to pit	819	387	59
PAF - dozer in pit	4,044	1,045	425
PAF - excavator loading trucks	176	83	13
PAF - haul to direct placement	8,404	2,363	236
PAF - unload to direct placement	227	107	16
PAF - haul to stockpile	915	257	26
PAF - unload to stockpile	25	12	28
PAF - rehandle - Ex loading trucks	25	12	2
PAF - rehandle - Haul to pit	942	265	27
PAF - rehandle - unload to pit	25	12	2
Ore			
Excavator loading truck	596	282	43
Haul to MUP	26,020	7,317	732
Unload at MUP	851	403	61
FEL/Dozer at MUP	15,281	3,491	1,605
Ore screening at MUP	3,083	1,037	70
Product and waste			
HMC - loading stockpiles	152	72	11

Table 17. Estimated emissions (kg/year) - Year 1

Activity	TSP	PM_{10}	$PM_{2.5}$
HMC - loading trucks	152	72	11
HMC - haul off-site	49,876	14,026	1,403
WHIMS product drying (Baghouse Stack)	603	603	603
WHIMS product screening	715	241	16
Illmenite - loading trucks	197	93	14
Illmenite - haul off-site	64,839	18,234	1,823
Tailings - loading trucks	2,645	1,251	189
Tailings - haulage to pit	79,384	22,324	2,232
Tailings - unload to pit	2,645	1,251	189
Wind erosion			
Active pit	51,000	25,500	3,825
NSOB stockpile	29,750	14,875	2,231
SOB stockpile	59,500	29,750	4,463
Soil stockpile	17,000	8,500	1,275
MUP stockpile	3,825	1,913	287
Product stockpiles	459	230	34
Exposed tailings	8,011	4,006	601
Miscellaneous			
Grader	44,043	15,388	15,388
Total (kg/yr)	**1,874,684**	**587,677**	**89,269**

Table 18. Estimated emissions (kg/year) - Year 4

Activity	TSP	PM_{10}	$PM_{2.5}$
Soil stripping and re-handling			
Dozer clearing vegetation	5,883	1,260	618
Scraper stripping soil	57,316	34,389	1,777
Scraper unload	39,528	23,717	1,225
Soil re-handle (excavator to truck)	1,489	704	107
Soil re-handle (haul to pit)	28,653	8,058	806
Soil re-handle (truck unload)	1,489	704	107
Dozer soil spreading	4,323	926	454
Overburden			
NSOB - dozer in pit	52,755	14,526	5,539
NSOB - excavator loading trucks	2,877	1,361	206
NSOB - haul to direct placement	99,981	28,116	2,812
NSOB - unload to direct placement	2,543	1,203	182
NSOB - haul to stockpile	61,622	17,329	1,733
NSOB - unload to stockpile	1,567	741	112

Table 18. Estimated emissions (kg/year) - Year 4			
SOB - dozer in pit	138,308	38,082	14,522
SOB - excavator loading trucks	7,543	3,568	540
SOB - haul to direct placement	659,051	185,333	18,533
SOB - unload to direct placement	10,776	5,097	772
PAF - dozer in pit	19,301	4,989	2,027
PAF - excavator loading trucks	905	428	65
PAF - haul to direct placement	58,093	16,336	1,634
PAF - unload to direct placement	1,293	611	93
Ore			
Excavator loading truck	794	376	57
Haul to MUP	104,011	29,249	2,925
Unload at MUP	1,135	537	81
FEL/Dozer at MUP	27,383	6,256	2,875
Ore screening at MUP	4,108	1,382	93
Product and Waste			
HMC - loading stockpiles	152	72	11
HMC - loading trucks	152	72	11
HMC - haul off-site	49,876	14,026	1,403
WHIMS product drying (Baghouse Stack)	603	603	603
WHIMS product screening	715	241	16
Illmenite - loading trucks	197	93	14
Illmenite - haul off-site	64,839	18,234	1,823
Tailings - loading trucks	4,059	1,920	291
Tailings - haulage to pit	132,287	37,201	3,720
Tailings - unload to pit	4,059	1,920	291
Wind Erosion			
Active pit	51,000	25,500	3,825
NSOB stockpile	39,100	19,550	2,933
SOB stockpile	59,500	29,750	4,463
Soil stockpile	34,000	17,000	2,550
MUP stockpile	3,825	1,913	287
Product stockpiles	459	230	34
Exposed tailings	8,011	4,006	601
Miscellaneous			
Grader	95,496	33,366	33,366
Total (kg/yr)	**1,941,056**	**630,969**	**116,134**

Table 19. Estimated emissions (kg/year) - Year 7

Activity	TSP	PM_{10}	$PM_{2.5}$
Soil stripping and re-handling			
Dozer clearing vegetation	6,042	1,294	634
Scraper stripping soil	38,106	22,864	1,181
Scraper unload	26,280	15,768	815
Soil re-handle (excavator to truck)	1,467	694	105
Soil re-handle (haul to pit)	22,420	6,305	630
Soil re-handle (truck unload)	1,467	694	105
Dozer soil spreading	6,580	1,409	691
Overburden			
NSOB - dozer in pit	231,478	63,735	24,305
NSOB - excavator loading trucks	8,172	3,865	585
NSOB - haul to direct placement	636,659	179,036	17,904
NSOB - unload to direct placement	10,599	5,013	759
NSOB - haul to stockpile	64,611	18,169	1,817
NSOB - unload to stockpile	1,076	509	77
NSOB - NP rehandle - excavator loading trucks	468	221	34
NSOB - NP rehandle - haul to pit	40,180	11,299	1,130
NSOB - NP rehandle - unload to pit	669	316	48
NSOB - rehandle - excavator loading trucks	1,431	677	102
NSOB - rehandle - haul to pit	530	45,198	4,520
NSOB - rehandle - unload to pit	2,044	967	146
Ore			
Excavator loading truck	822	389	59
Haul onsite at NP	219,705	61,784	6,178
Haul to MUP	1,242,905	349,519	34,952
Unload at MUP	1,174	555	84
FEL/Dozer at MUP	49,636	11,340	5,212
Ore screening at MUP	4,250	1,429	97
Product and Waste			
HMC - loading stockpiles	152	72	11
HMC - loading trucks	152	72	11
HMC - haul off-site	49,876	14,026	1,403
WHIMS product drying (Baghouse Stack)	603	603	603
WHIMS product screening	715	241	16
Illmenite - loading trucks	197	93	14
Illmenite - haul off-site	64,839	18,234	1,823

Table 19. Estimated emissions (kg/year) - Year 7			
Tailings - loading trucks	4,353	2,059	312
Tailings - haulage to pit	201,615	56,696	5,670
Tailings - unload to pit	4,353	2,059	312
Wind Erosion			
Active pit	25,500	12,750	1,913
NSOB stockpile	42,500	21,250	3,188
SOB stockpile	59,500	29,750	4,463
Soil stockpile	25,500	12,750	1,913
MUP stockpile	3,825	1,913	287
Product stockpiles	425	213	32
Exposed tailings	7,990	3,995	599
Miscellaneous			
Grader	79,612	27,816	27,816
Total (kg/yr)	**3,190,476**	**1,007,639**	**152,553**

7.2 Emission reduction measures

A number of control measures were incorporated into the emission calculations and the relevant emission reductions applied are summarised in **Table 20**. Other control measures, while not explicitly applied as a reduction factor, have been accounted for in emission estimates on the basis of the latest mine planning, including:

- Direct in-pit placement of overburden where possible, reducing the double handling of material, potential for wind erosion and haulage distances.
- Progressive rehabilitation of disturbed project area.
- Minimising the double handling of material, wherever practicable.
- Avoiding disturbance, or temporary rehabilitation of long-term soil and overburden stockpiles.

In addition to the preventative measures outlined above, reactive or corrective measures would be employed. For example, during periods of dry, windy conditions where watering is not sufficient, certain activities may be ceased or relocated to more sheltered areas.

The proposed control measures are based on the recommendations of the NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining (Katestone, 2011). In particular, the control measures for the most significant sources of emissions (hauling, wind erosion and dozers) are comparable to current best practise control measures.

Table 20. Air pollution control measures

Activity	Measure	Control Efficiency
Excavators loading material to trucks	Minimise drop height	30%(1)
Front end loaders loading ROM ore to dump hoppers	Minimise drop height	30%(1)
Wheel generated emission from unpaved on-site access roads	Watering	85%(2)
Wheel generated emission from other unpaved off-site roads	Chemical suppression	91%(3)
Emissions from Processing Plant area	Exhaust filtered through baghouse before being emitted	n/a (6)

Notes:

1) *NSW Coal Mining Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (Katestone Environmental, 2011)
2) *NPI Manual for Mining* (NPI 2012) specifies a control efficiency of 75% for Level 2 watering, however extensive measurements conducted under the NSW EPA “dust stop” PRPs has indicated that greater than 90% control can be achieved through watering alone. A recently completed ACARP project found that watering alone can achieve 85% - 95% (Cox et al, 2014). This level of control is also supported by the literature (SKM, 2005; Buonicore and Davis, 1993) which state that controls of 90% and 95% can be achieved through watering.
3) Control efficiency for chemical suppression varies between 20% to 99% depending on chemical type and application (refer to **Appendix D** for more details). A value of 91% adopted for this assessment.
4) Emission rates from the stack are based on manufacturer specifications (**Appendix D**) and incorporate the emission reduction due to air pollution control device (ie baghouse).

7.3 Construction stage

The initial construction phase of the Balranald Project is expected to take approximately 2.5 years from commencement. The construction phase would commence at the West Balranald mine, and would involve all non-mining related activities including:

- site establishment including establishment of construction compound and bulk earthworks;
- construction of the West Balranald access road, and southern portion of the Nepean access road and internal roads;
- construction of the accommodation facility;
- gravel extraction from borrow pits;construction of buildings, workshops, security fencing, and other ancillary facilities;

- installation of groundwater management (extraction and injection) infrastructure at the West Balranald mine and injection borefields;
- establishment and commissioning of the processing plant; and
- construction of the water supply pipeline.

Construction of infrastructure at the Nepean mine would commence from approximately Year 5 of operation. Normal operating hours during construction will be 24 hours per day.

The dust generating sources during construction phase will include wheel-generated dust from trucks supplying material and equipment to site, site clearing, drilling, graders on unpaved roads, material handling by excavators and dozers and wind erosion from cleared areas and stockpiles. Whereas the location of dust generating activities during the construction stage are similar to a large extent with dust generating activities during operational stages, the intensity of construction emissions are expected to be significantly lower than for operational years. Consequently, construction stage emissions were not inventoried or modelled. Dust emissions from site clearing and topsoil stripping, wind erosion and development of the box cut are, however, accounted for within the emission inventories compiles for operational stages (**Section 7.1** and **Appendix D**).

7.4 Trace metals components of fugitive dust

Fugitive PM emissions from Balranald Project operations will include trace levels of metals and toxic components. To provide an estimate of metal emissions, reference was made to metals analysis undertaken for the various materials handled, including:

- Metal analysis of topsoil and subsoil provided by SLR Consulting.
- Metal analysis of five ROM ore samples, four saline overburden (SOB)/ non-saline overburden (NSOB) samples and three potentially acid forming (PAF) samples provided by Klohn Crippen Berger.
- Metal analysis of two tailings samples provided by Iluka.

A summary of the metal analysis is presented in **Table 21**. Trace metal content was calculated based on arithmetic average across all samples. Where information was available (e.g. mass or volume of material handled), metal content was determined based on a weighted average across samples.

The metal content presented in **Table 21** are converted to percentages and then applied to scale the PM modelling results to derive ground level concentrations for each metal. The scaling is applied by material type. For each compound other than lead, ground level concentrations are derived from the 1-hour predicted PM_{10} ground level concentrations, at the 99.9^{th} percentile. The annual average TSP predictions are used for lead.

The NSOB metal profile was used to quantify metal emissions from wheel generated dust on unpaved roads while the metal profile for ROM ore was used to estimate emissions from product handling. It is recognised that the metal content is likely to vary with particle size class. Insufficient information was available to characterise specifically the metal content of the PM_{10} fraction. The metal content was therefore assumed representative across particle size fractions.

Table 21. Metal/ metalloid content of various materials handled

Metals/ Metalloid	Topsoil	Subsoil	NSOB/SOB	PAF	ROM Ore	Tailings
	Unit: mg/kg					
Antimony	5.0	5.0	1.5	1.0	3.2	-
Arsenic	1.0	1.0	8.8	13.0	68.8	140.0
Barium	-	-	326.5	160.7	272.2	1,475.5
Beryllium	-	-	0.9	0.4	3.0	-
Cadmium	0.2	0.2	-	0.5	0.5	116.0
Copper	9.8	.1	14.6	8.7	16.2	12.0
Iron	13,027.9	12,660.0	28,950.0	23,166.7	122,320.0	101,591.0
Lead	3.3	2.5	7.3	11.5	82.2	68.0
Magnesium	-	-	1,382.5	533.3	296.0	4,728.0
Manganese	257.1	221.9	177.5	277.3	3,076.0	1,289.7
Mercury	0.1	0.1	-	-	-	-
Nickel	7.7	6.7	16.5	10.3	23.8	96.0
Silica	-	-	-	-	-	149,341.3
Silver	2.5	2.5	0.3	0.3	0.3	-
Zinc	16.9	15.4	29.0	26.0	181.2	512.5

7.5 Stack emissions

The ISP baghouse would be designed to meet the POEO (Clean Air) limits prescribed in **Section 4.7**. Particulate matter emissions from the baghouse stack are accounted for in the particulate matter emission estimates presented in **Section 7.1**, based on an in-stack concentration limit of 50 mg/Nm^3 (which is assumed for each particle size metric). The actual emissions from the stack are expected to be considerably lower. The assumed stack design and operating parameters are given in **Table 22**.

Table 22. Baghouse stack parameters

Stack Parameter	Design
Stack height	25 m above ground
Stack diameter at discharge point	1.5 m
Exhaust discharge temperature	Ambient
Exhaust discharge velocity	10 m/s
Volumetric flow rate (average)	17.7 Nm^3/s

Other emissions associated with Liquefied Petroleum Gas (LPG) combustion within the dryer have not been quantified or assessed. Based on separation distances over more than 5 km to the nearest assessment locations, combustion related emissions would not result in significant ground level concentrations. Similarly, combustion emissions from diesel plant and equipment are not assessed due to the significant buffer distances between mining activity and assessment locations.

8 Modelling approach

The atmospheric dispersion modelling carried out within this assessment utilises the USEPA regulatory AERMOD model. AERMOD is designed to handle a variety of pollutant source types, including surface and buoyant elevated sources, in a wide variety of settings such as rural and urban as well as flat and complex terrain.

AERMOD replaced the Industrial Source Complex (ISC) model for regulatory purposes in the US in December 2006 as it provides more realistic results, with concentrations that are generally lower and more representative of actual concentrations compared to the conservative ISC model. Ausplume, a steady-state Gaussian plume dispersion model developed by the Victorian EPA and frequently used in Australia for simple near-field applications, is largely based on the ISC model. Compared to ISC and Ausplume, AERMOD represents an advanced new-generation model, which requires additional meteorological and land-use inputs to provide more refined predictions.

AERMOD was identified as the most suitable model for application for the Balranald Project due to the source types (predominately surface based, non-buoyant fugitive releases) and the observed low spatial variability of the meteorological conditions, notably in relation to wind direction. A detailed account of the model selection and modelling methodology is presented in **Appendix B**.

The dispersion of pollutants was modelled for an area covering 80 km by 130 km centred over the West Balranald and Nepean mines. The large domain was necessary to model simultaneous operations across the project area, as well as ore transportation from the Nepean mine to the West Balranald mine for processing. A coarse resolution Cartesian receptor grid (2.5 km x 2.5 km) was generated for the full domain with a nested finer resolution Cartesian receptor grid (1 km x 1 km) centred over an area close to each project area. The discrete assessment locations listed in **Appendix A** were also included.

As discussed in **Section 5.2**, the calendar year 2011 was chosen as the meteorological period for the dispersion modelling. Emissions were estimated based on activity data for three operational years: Year 1, Year 4 and Year 7. Location of sources, including haul roads, ore and waste loading/unloading activities, dozer operations and wind erosion were selected based on the indicative equipment locations provided by Iluka.

9 Impact assessment

9.1 Year 1 operations

The predicted ground level concentrations (GLCs) at the ten most impacted assessment locations are presented in Table 23. The complete list of modelling predictions at all 345 assessment locations are presented in **Appendix E**.

The incremental increase in GLCs from the Balranald Project is presented in Table 23, as well as cumulative annual average GLCs for TSP, PM_{10}, $PM_{2.5}$ and dust deposition (based on the background PM concentrations described in **Section 6**).

Additional cumulative assessment for short term (24-hour average) PM_{10} and $PM_{2.5}$ is presented in **Section 9.4** and **Section 9.5**.

The modelling results presented in Table 23 indicate that there are no predicted exceedances of the annual average impact assessment criteria (increment or cumulative) for PM_{10}, $PM_{2.5}$, TSP or dust deposition. The maximum incremental 24-hour PM_{10} concentration is 27.7 µg/m³, predicted to occur at assessment location R276. The maximum incremental 24-hour $PM_{2.5}$ concentration is 4.6 µg/m³, also predicted to occur at assessment location R276. It is noted that this assessment location is not a dwelling.

Contour plots of predicted ground level concentrations for Year 1 operations are presented in **Figure 14**, **Figure 15** and **Figure 16**.

Table 23. Year 1 operations – modelling predictions for the 10 most impacted assessment locations

Assessment location	Assessment location type	PM10 concentration (µg/m³)			PM2.5 concentration (µg/m³)			TSP concentration (µg/m³)		Dust Deposition (g/m²/month)	
		24-hour Max	Annual average		24-Hour max	Annual Average		Annual Average		Annual Average	
		50 µg/m³	*30 µg/m³*		*25 µg/m³*	*8 µg/m³*		*90 µg/m³*		*2 g/m²/m*	*4 g/m²/m*
		Increment	Increment	Cumulative	Increment	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative
R276	Shed	24.7	3.8	21.8	4.6	0.8	7.3	7.0	50.8	0.18	1.32
R277	Shed	19.9	2.9	20.9	3.9	0.6	7.1	5.3	49.1	0.12	1.26
R281	Shed	13.5	1.0	19.0	2.4	0.2	6.7	1.6	45.4	0.03	1.17
R36	Shearing Shed	12.8	1.8	19.8	2.4	0.4	6.9	3.1	46.9	0.06	1.20
R403	Shed	11.1	0.7	18.7	1.9	0.1	6.6	1.0	44.8	0.01	1.15
R402	Shed	10.8	0.7	18.7	1.8	0.1	6.6	1.0	44.8	0.01	1.15
R5	Homestead	10.5	0.8	18.8	2.3	0.2	6.7	1.3	45.1	0.02	1.16
R2	Homestead	10.4	0.7	18.7	1.8	0.1	6.6	1.0	44.8	0.01	1.15
R92	Unknown	9.2	0.8	18.8	1.8	0.2	6.7	1.4	45.2	0.03	1.17
R405	Shed	8.6	0.7	18.7	1.5	0.1	6.6	1.1	44.9	0.01	1.15

Maximum 24-hour average PM_{10}

Annual average PM_{10}

Figure 14. Incremental ground level concentration contour – PM_{10} Year 1

	
Maximum 24-hour average $PM_{2.5}$	Annual average $PM_{2.5}$

Figure 15. Incremental ground level concentration contour – $PM_{2.5}$ Year 1

Annual average TSP

Annual average dust deposition

Figure 16. Incremental ground level concentration contour – TSP and dust deposition Year 1

9.2 Year 4 operations

The predicted ground level concentrations (GLCs) at the ten most affected assessment locations are presented in Table 24. The complete list of modelling predictions at all 345 assessment locations are presented in **Appendix E**.

The incremental increase in GLCs from the Balranald Project is presented, as well as cumulative annual average GLCs for TSP, PM_{10}, $PM_{2.5}$ and dust deposition (based on the background PM concentrations described in **Section** 6).

Additional cumulative assessment for short term (24-hour average) PM_{10} and $PM_{2.5}$ is presented in **Section 9.4** and **Section 9.5**.

The results presented in Table 24 indicate that there are no predicted exceedances of the annual average impact assessment criteria (increment or cumulative) for PM_{10}, $PM_{2.5}$, TSP or dust deposition.

The maximum incremental 24-hour PM_{10} concentration is 43.9 µg/m³, predicted to occur at assessment location R5. The maximum incremental 24-hour $PM_{2.5}$ concentration is 5.9 µg/m³, also predicted to occur at assessment location R5. Assessment location R5 is a dwelling, however it is noted that the dwelling is not currently habitable.

Contour plots of predicted ground level concentrations for Year 4 operations are presented in **Figure 17**, **Figure 18** and **Figure 19**.

Table 24. Year 4 operations – modelling predictions for the 10 most impacted assessment locations

Assessment location	Assessment location type	PM_{10} concentration (µg/m³)			$PM_{2.5}$ concentration (µg/m³)			TSP concentration (µg/m³)		Dust Deposition (g/m²/month)	
		24-hour Max	Annual average		24-Hour max	Annual Average		Annual Average		Annual Average	
		50 µg/m³	*30 µg/m³*		*25 µg/m³*	*8 µg/m³*		*90 µg/m³*		*2 g/m²/m*	*4 g/m²/m*
		Increment	Increment	Cumulative	Increment	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative
R5	Homestead	43.9	4.4	23.3	5.9	1.2	7.7	7.1	50.9	0.08	1.22
R403	Shed	9.6	1.3	20.2	1.6	0.3	6.8	2.0	45.8	0.03	1.17
R402	Shed	9.6	1.3	20.2	1.6	0.3	6.8	2.0	45.8	0.03	1.17
R2	Homestead	9.5	1.2	20.1	1.6	0.3	6.8	2.0	45.8	0.03	1.17
R405	Shed	9.3	1.2	20.1	1.5	0.3	6.8	1.9	45.7	0.02	1.16
R277	Shed	8.9	0.8	19.7	1.3	0.2	6.7	1.3	45.1	0.02	1.16
R276	Shed	8.8	0.8	19.7	1.3	0.2	6.7	1.3	45.1	0.02	1.16
R362	Unknown	8.3	0.6	19.5	1 .3	0.2	6.7	1.0	44.8	0.01	1.15
R36	Shearing Shed	6.3	0.7	19.6	0.9	0.2	6.7	1.1	44.9	0.01	1.15
R366	Unknown	4.6	0.4	19.3	0.8	0.1	6.6	0.7	44.5	0.01	1.15

Maximum 24-hour average PM_{10}

Annual average PM_{10}

Figure 17. Incremental ground level concentration contour – PM_{10} Year 4

Maximum 24-hour average $PM_{2.5}$

Annual average $PM_{2.5}$

Figure 18. Incremental ground level concentration contour – $PM_{2.5}$ Year 4

Annual average TSP

Annual average dust deposition

Figure 19. Incremental ground level concentration contour – TSP and dust deposition Year 4

9.3 Year 8 operations

The predicted ground level concentrations (GLCs) at the ten most affected assessment locations are presented in Table 25. The complete list of modelling predictions at all 345 assessment locations are presented in **Appendix E**.

The incremental increase in GLCs from the Balranald Project is presented, as well as cumulative annual average GLCs for TSP, PM_{10}, $PM_{2.5}$ and dust deposition (based on the background PM concentrations described in **Section** 6).

Additional cumulative assessment for short term (24-hour average) PM_{10} and $PM_{2.5}$ is presented in **Section 9.4** and **Section 9.5**.

The results presented in Table 25 indicate that there are no predicted exceedances of the annual average impact assessment criteria (increment or cumulative) for PM_{10}, $PM_{2.5}$, TSP or dust deposition.

The maximum incremental 24-hour PM_{10} concentration is 20.8 µg/m³, predicted to occur at R281. The maximum incremental 24-hour $PM_{2.5}$ concentration is 6.5 µg/m³, predicted to occur at R5. As noted in Section 9.2, assessment location R5 is a dwelling, however it is noted that the dwelling is not currently habitable.

Contour plots of predicted ground level concentrations for Year 8 operations are presented in **Figure 20**, **Figure 21** and **Figure 22**.

Table 25. Year 8 operations – modelling predictions for the 10 most impacted assessment locations

Assessment location	Assessment location type	PM10 concentration (µg/m³)			PM2.5 concentration (µg/m³)			TSP concentration (µg/m³)		Dust Deposition (g/m²/month)	
		24-hour Max	Annual average		24-Hour max	Annual Average		Annual Average		Annual Average	
		50 µg/m³	*30 µg/m³*		*25 µg/m³*	*8 µg/m³*		*90 µg/m³*		*2 g/m²/m*	*4 g/m²/m*
		Increment	Increment	Cumulative	Increment	Increment	Cumulative	Increment	Cumulative	Increment	Cumulative
R281	Shed	20.8	7.0	25.0	1.8	0.6	7.1	8.5	52.3	0.2	1.3
R5	Homestead	16.2	1.8	19.8	6.5	0.6	7.1	2.8	46.6	0.03	1.17
R13	Homestead	5.1	1.9	19.9	0.8	0.3	6.8	3.9	47.7	0.07	1.21
R54	Homestead	4.6	0.8	18.8	0.6	0.1	6.6	1.3	45.1	0.02	1.16
R405	Shed	4.3	0.6	18.6	1.3	0.1	6.6	0.9	44.7	0.01	1.15
R419	Unknown	3.8	0.7	18.7	0.8	0.1	6.6	0.8	44.6	0.00	1.14
R12	Shearers Quarters	3.8	0.7	18.7	0.8	0.1	6.6	0.8	44.6	0.00	1.14
R2	Homestead	3.7	0.6	18.6	1.1	0.1	6.6	1.0	44.8	0.01	1.15
R402	Shed	3.7	0.6	18.6	1.1	0.1	6.6	1.0	44.8	0.01	1.15
R403	Shed	3.6	0.6	18.6	1.1	0.1	6.6	1.0	44.8	0.01	1.15

Maximum 24-hour average PM_{10}

Annual average PM_{10}

Figure 20. Incremental ground level concentration contour – PM_{10} Year 8

Maximum 24-hour average $PM_{2.5}$

Annual average $PM_{2.5}$

Figure 21. Incremental ground level concentration contour – $PM_{2.5}$ Year 8

Annual average TSP

Annual average dust deposition

Figure 22. Incremental ground level concentration contour – TSP and dust deposition Year 8

9.4 Cumulative 24-hour PM_{10}

There are no continuous PM_{10} data in the vicinity of the Balranald Project to apply a Level 2 cumulative assessment for 24-hour PM_{10}, as recommended by the Approved Methods. As outlined in **Section 6.2**, the OEH site at Albury provides the closest available continuous PM_{10} monitoring data, however the Broken Hill data, arguably the most suitable representative data, is not continuous and not contemporaneous with the meteorological data used in the modelling.

Cumulative impacts for 24-hour PM_{10} have therefore been evaluated using a statistical approach which presents the likelihood of the Balranald Project causing additional exceedances of the 24-hour average assessment criterion of 50 µg/m^3.

A frequency distribution of cumulative impact is presented showing every possible combination of predicted project increment and background concentration (i.e. every modelling prediction is added to all available background values).

The process assumes that any background value from the data set could occur on any given day of the Balranald Project operation. The background values used in the cumulative analysis include the Broken Hill data (2-3 years), Wagga Wagga data (10 years) and the Albury data (10 years). In using all available background values, an extensive range of potential background conditions are assessed.

The frequency distribution is presented for selected assessment locations surrounding the Balranald Project and shown in **Figure 23**, **Figure 24** and **Figure 25** for each mine year.

The analysis shows that the risk of additional exceedances of the 24-hour PM_{10} impact assessment criteria is low, summarised as follows:

- During Year 1 operations, the highest risk occurs at assessment location R276 (a shed) where the probability of additional days over 50 µg/m^3 is approximately 1%. At all other assessment locations, the probability is less than 0.2%.
- During Year 4 operations, the highest risk occurs at assessment location R5 (a dwelling, although currently not habitable) where the probably of additional days over 50 µg/m^3 is approximately 2.3%. At all other assessment locations, the probability is less than 0.4%.
- During Year 7 operations, the highest risk occurs at assessment location R281 (a shed) where the probability of additional days over 50 µg/m^3 is approximately 1.8%. At all other assessment locations, the probability is less than 0.5%.

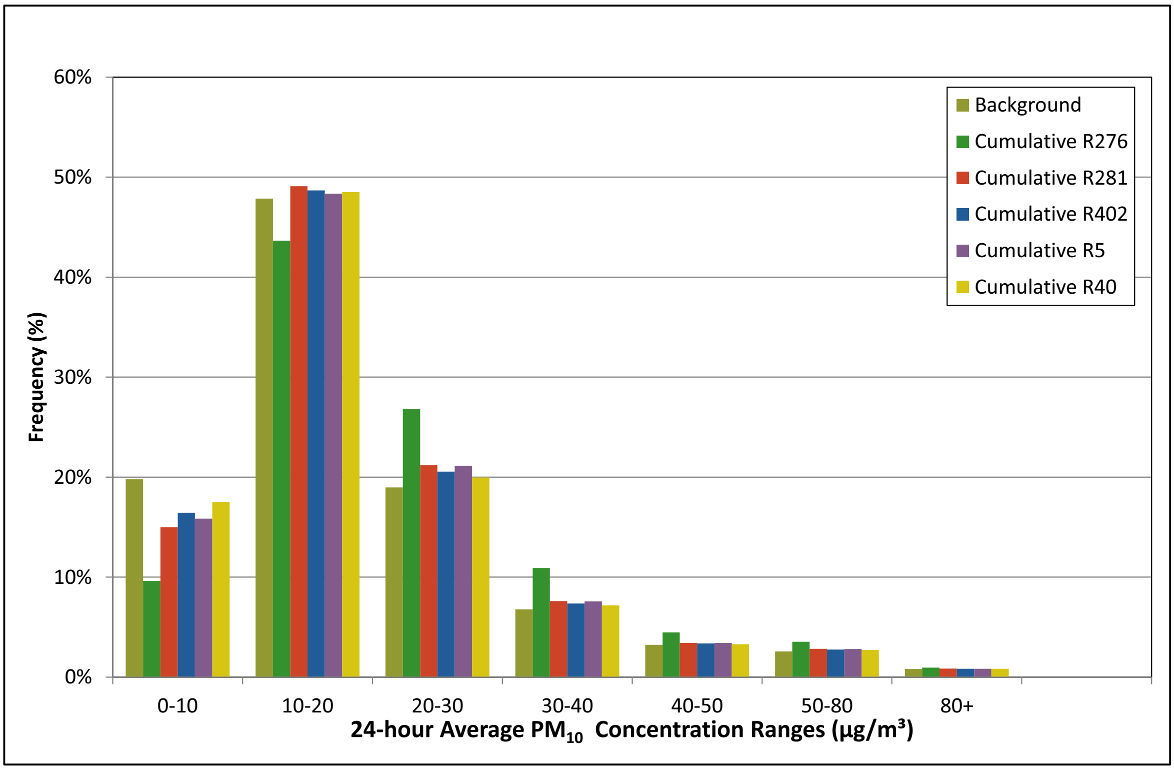

Figure 23. Frequency distribution of cumulative 24-hour average PM_{10} concentration – Year 1

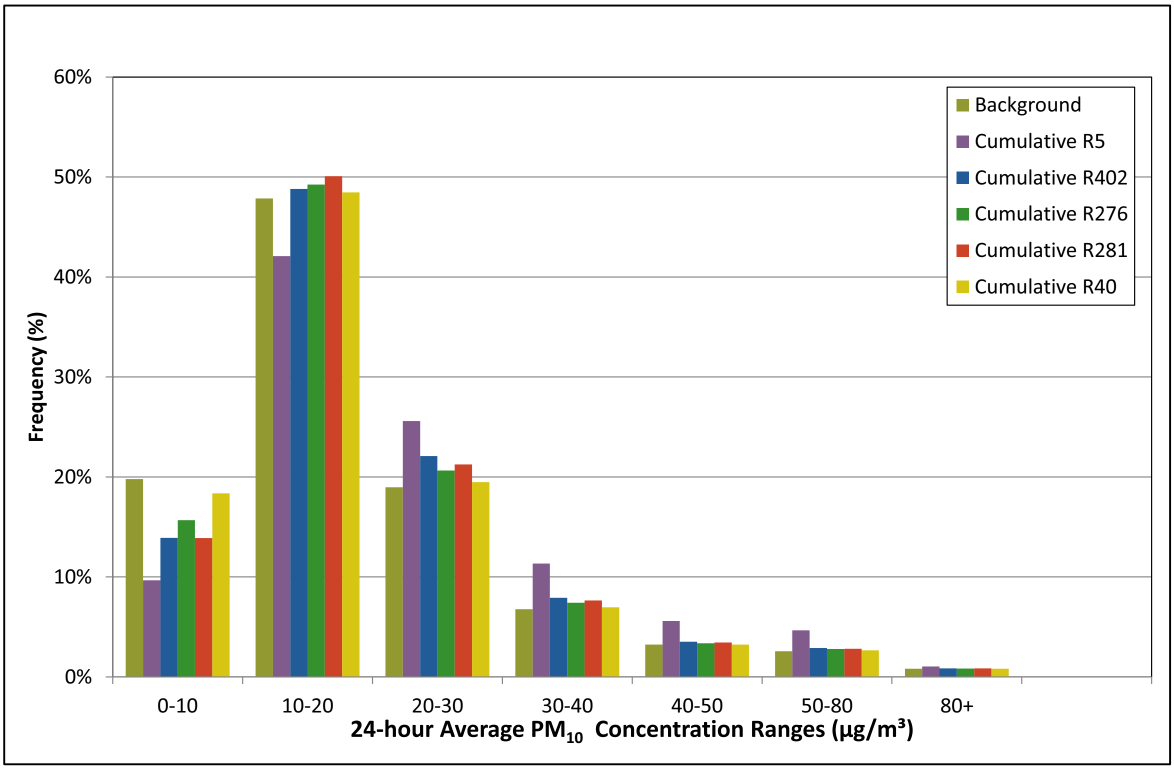

Figure 24. Frequency distribution of cumulative 24-hour average PM_{10} concentration – Year 4

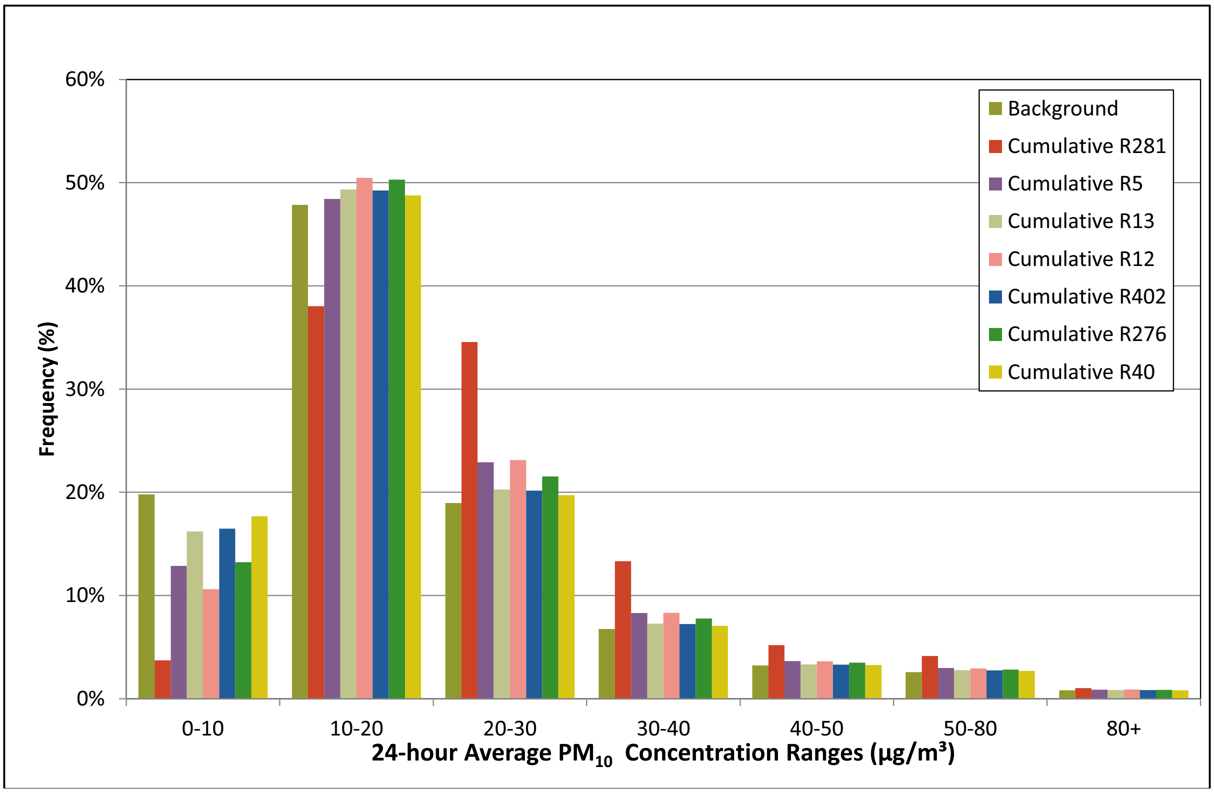

Figure 25. Frequency distribution of cumulative 24-hour average PM_{10} concentration – Year 8

9.5 Cumulative 24-hour $PM_{2.5}$

A similar statistical analysis is presented for $PM_{2.5}$, determining the likelihood of the Balranald Project causing additional exceedances of the 24-hour advisory reporting standard of 25 µg/m^3. To derive a background dataset for $PM_{2.5}$ (in the absence of available monitoring data), a ratio is applied to the PM_{10} background, as described in **Section 6.2.4**.

The frequency distribution is presented for selected assessment locations surrounding the Balranald Project and shown in **Figure 26**, **Figure 27** and **Figure 28** for each mine year.

The analysis shows that the risk of additional exceedances of the 24-hour $PM_{2.5}$ impact assessment criteria is negligible (less than 0.1%) for all years.

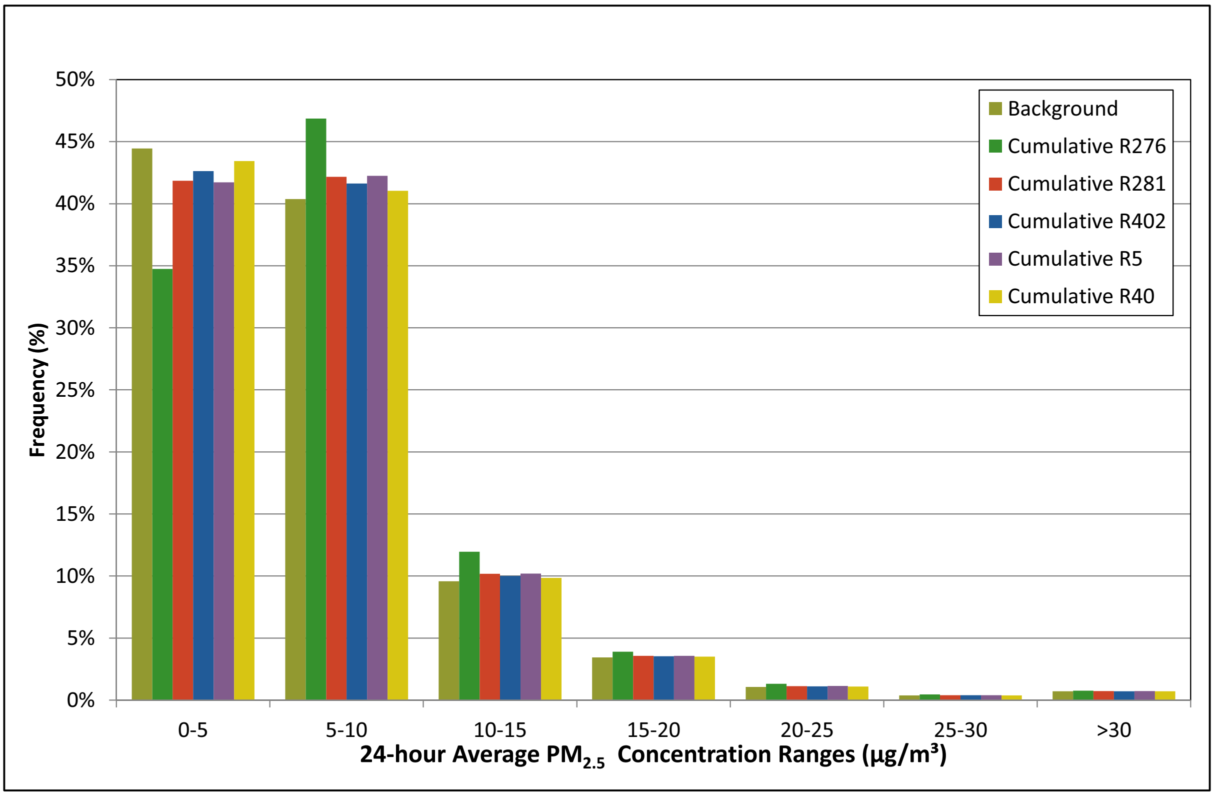

Figure 26. Frequency distribution of cumulative 24-hour average $PM_{2.5}$ concentration – Year 1

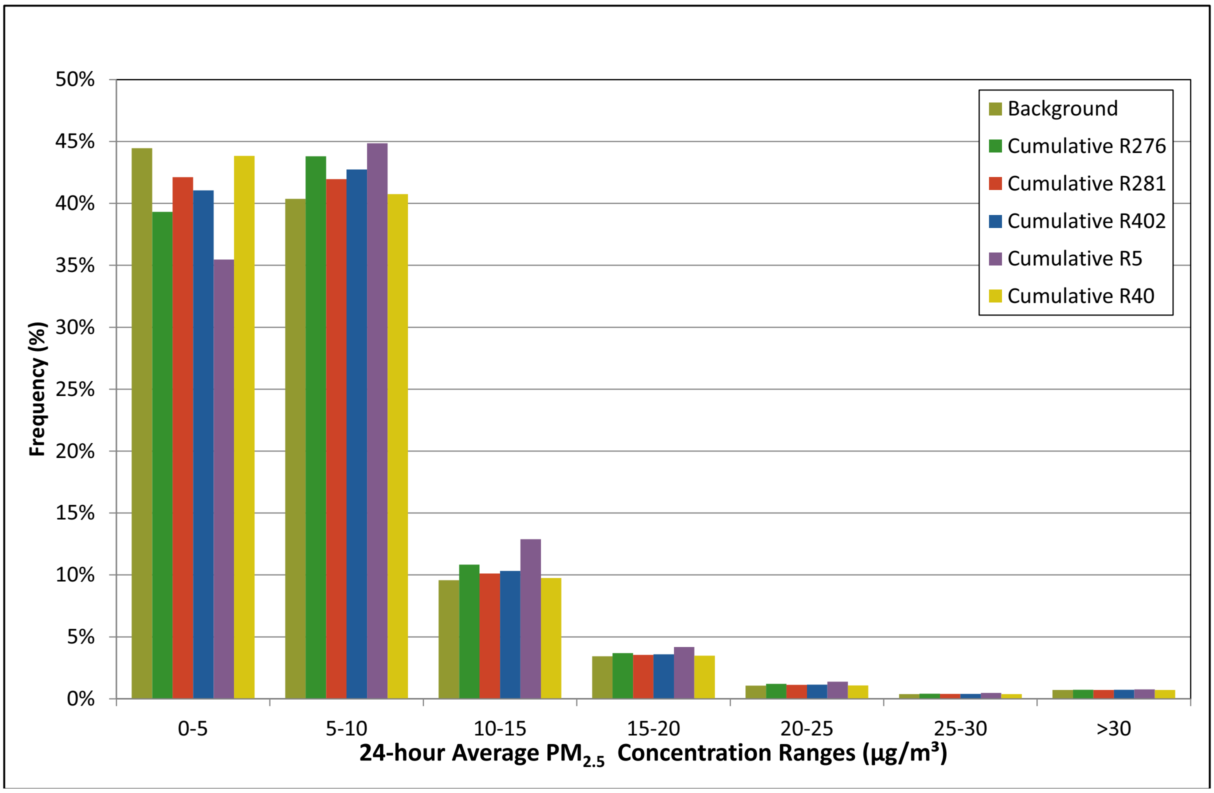

Figure 27. Frequency distribution of cumulative 24-hour average $PM_{2.5}$ concentration – Year 4

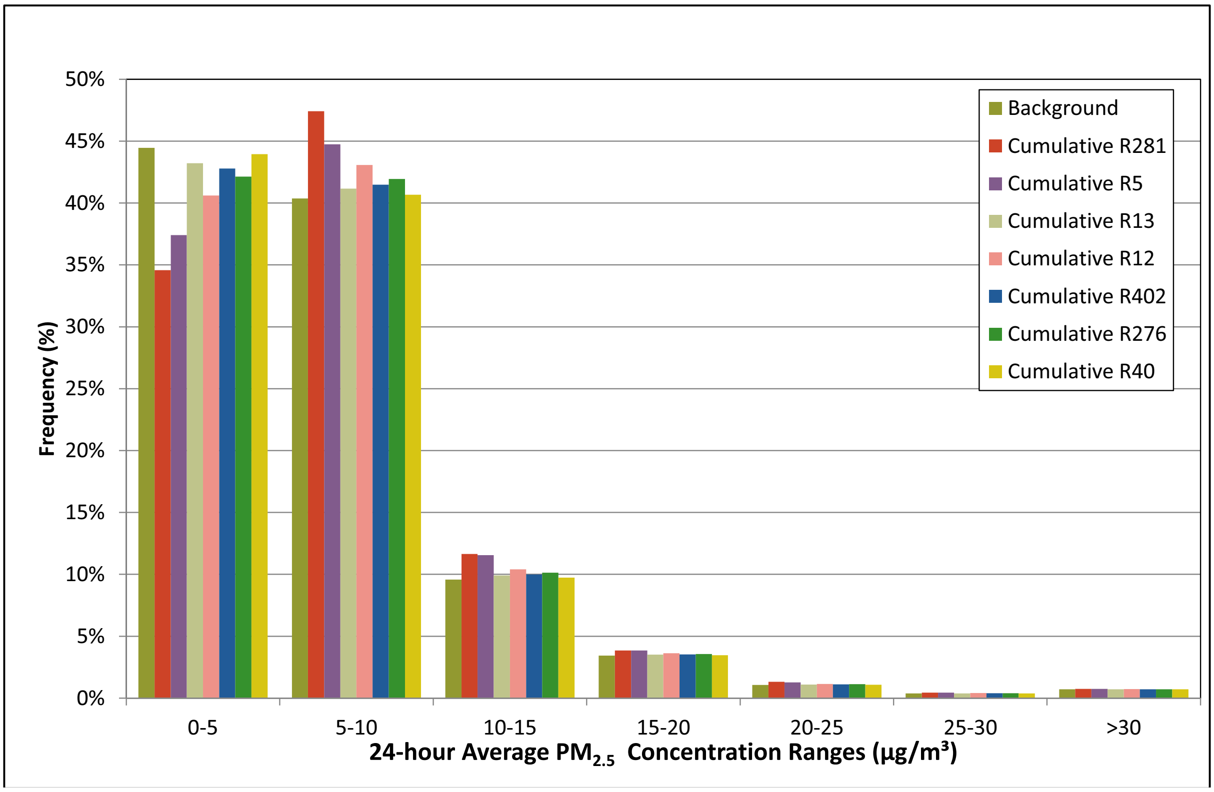

Figure 28. Frequency distribution of cumulative 24-hour average $PM_{2.5}$ concentration – Year 8

9.6 Assessment of toxic air pollutants

The peak predicted incremental 99.9th percentile concentrations (for metal/metalloids) and cumulative annual average concentrations (for Lead and RCS) are presented in **Table 26** for each of the three modelled operation years.

For all metals except lead, criteria are applied at and beyond the site boundary and results are therefore presented as the grid maximum (in other words the highest prediction across the modelling grid. For lead and RCS, the maximum prediction at an assessment location is presented.

It can be seen that for all pollutants and averaging periods, the predicted concentrations are well below the relevant assessment criteria for all assessed stages of the Balranald Project. Even when a conservative background of 0.7 µg/m³ is added to the maximum prediction for RSC, the cumulative concentration is less than 25% of the impact assessment criteria.

Table 26. Grid maximum metal / metalloid/ RCS concentrations

Pollutant	Criteria µg/m³	Grid maximum across assessment locations µg/m³		
		Year 1	Year 4	Year 7
Antimony	9	0.0027	0.005	0.003
Arsenic	0.09	0.0124	0.01	0.06
Barium	9	0.0933	0.10	0.23
Beryllium	0.004	0.0007	0.0007	0.0024
Cadmium	0.018	0.0019	0.0019	0.0004
Copper	3.7	0.007	0.011	0.013
Iron	90	27.8	28.0	100.3
Magnesium	180	0.08	0.30	0.29
Manganese	18	0.7	0.7	2.5
Mercury	0.18	0.000029	0.00005	0.000022
Nickel	0.18	0.005	0.009	0.020
Silver	1.8	0.001	0.003	0.001
Zinc	18	0.04	0.04	0.15
Lead	0.5	0.00001	0.00004	0.0001
RSC	3	0.01	0.01	0.01

10 Mitigation and monitoring

10.1 Construction phase

As discussed in **Section 7.3**, the intensity of emissions from construction are expected to be significantly lower than for operational years, however ,the following mitigation measures will be implemented to minimise dust generation:

- Minimising the extent of exposed areas as far as practical throughout the construction phase.
- Stabilise exposed areas as soon as practical.
- Apply watering to roads and other trafficked areas, with consideration of the application of water extenders to improve the control effectiveness of wet suppression.
- Consider the prevailing wind direction and speed in short term planning of construction activities, particularly when such activities are close to dwellings.
- Cease or modify construction activities under adverse meteorological conditions (dry, windy conditions) when dwellings are located downwind.
- Minimise double handling of material.
- Locate temporary construction stockpiles in sheltered areas where possible.

10.2 Operational phase

Section 7 provides an overview of the mitigation measures and practices proposed for implementation during the operation of the Balranald Project to minimise the level of impact on the surrounding environment. These controls were incorporated into the modelling wherever an appropriate emission reduction factor was available. In addition to these operational controls, Iluka proposes to adopt a pragmatic approach towards minimising the potential for air quality exceedances at assessment locations. During daily operations, the need to cease, modify or relocate operations would be based on visual observations from onsite personnel and adverse meteorological conditions, informed by the onsite meteorological monitoring station.

10.3 Monitoring

The predicted ground level concentrations of TSP, PM_{10}, $PM_{2.5}$ and dust deposition are well below the impact assessment criteria at all residential dwellings. A significant buffer distance of 5 km exists between Project operations and the nearest occupied dwelling (R5) and the air quality risk on the Balranald township is negligible.

The proposed monitoring is therefore limited to a network of dust deposition gauges (DDGs) which would be used to monitor the change in local dust levels due to the operation of the Project. The number and location of the dust deposition gauges would be outlined in an Air Quality Management and Monitoring Plan, however it is anticipated that the number of locations would be consistent with similar operations in the region, including the Iluka WSP mine (5 DDGs) and the Cristal Mining Atlas-Campaspe mine (6 DDGs).

Iluka also proposes to operate a meteorological monitoring station onsite. The station would be installed and operated in accordance with the following guidance:

- NSW EPA Approved methods for the sampling and analysis of air pollutants in NSW (NSW EPA 2005a)

- Australian Standard (AS/NZS) 3580.14:2014 – Methods for the sampling and analysis of ambient air – Meteorological monitoring for air quality applications.

The meteorological station would record measurements of wind speed, direction, temperature (2m and 10m), solar radiation, relative humidity and rainfall. The purpose of the meteorological station is to:

- Provide the site with daily, monthly and yearly weather summaries.
- Provide information on ongoing trends, for example monthly rainfall statistics.
- Assist the site in responding to dust complaints by helping to identify the source of dust (based on wind measurements).
- Identify excessive temperatures to inform stop work requirements under OHS requirements.
- Provide weather observations to support noise monitoring (as required).
- Will enable calculations of stability class for noise assessment (as required).
- Will provide site specific weather observations for future air quality assessment (as required).

11 Greenhouse gas assessment

11.1 Introduction

In addition to local air quality impacts, the operation of the Balranald Project will generate greenhouse gas (GHG) emissions. GHGs are gases present in the atmosphere that have the ability to absorb long-wave radiation reflected from the Earth's surface, adding heat to the atmosphere. GHGs include water vapour, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

With the exception of water vapour, atmospheric concentrations of GHGs are influenced by human activities. The Intergovernmental Panel on Climate Change (IPCC, 2014) states that over the past 250 years, atmospheric concentrations of CO_2, CH_4, N_2O and other GHGs have increased significantly and are attributable to human activities since the Industrial Revolution. The extra heat absorbed by increasing quantities of GHGs in the atmosphere has been linked by the IPCC to observed changes in the climate system over recent decades.

11.2 Organisational boundary

The organisational boundary for this assessment has been defined using the Operational Control approach, which is defined in the NGERS Act (Australian Government, 2007). In the case of the Balranald Project, Iluka will account for 100% of GHG emissions over which it has operational control. It will not account for emissions in which it owns an interest but does not have operational control.

Section 11 of the NGERS Act defines Operational Control as follows:

> *A corporate group member has operational control of a facility if it has the authority to introduce and implement any or all of the operating, health and safety and environmental policies for the facility. Only one corporation or group member can have operational control of a facility at a time.*
>
> *If there is uncertainty as to which corporation or member has operational control of a facility, the corporation or member deemed to have operational control will be the one with the greatest authority to introduce and implement operating and environmental policies.*

The operation of the Balranald Project will rely on a number of contractors. Iluka will account for emissions associated with its major contractors under its own Scope 1 and 2 emissions (as defined below), since it has authority to implement OHS and environmental policies in relation to the activity of these contractors at the project area.

11.3 Emission scopes

Direct and indirect GHG emissions are defined within the National Greenhouse Accounts Factors (NGAF) workbook (DoE, 2014a), as follows:

Direct emissions *are generated from sources within the boundary of an organisation and as a result of that organisation's activities. These emissions mainly arise from the following activities:*

- *generation of energy, heat, steam and electricity, including carbon dioxide and products of incomplete combustion (methane and nitrous oxide).*
- *manufacturing processes which produce emissions (for example, cement, aluminium and ammonia production).*
- *transportation of materials, products, waste and people; for example, use of vehicles owned and operated by the reporting organization.*
- *fugitive emissions: intentional or unintentional GHG releases (such as methane emissions from coal mines, natural gas leaks from joints and seals).*
- *on-site waste management, such as emissions from landfill sites.*

***Indirect emissions** are emissions generated in the wider economy as a consequence of an organisation's activities (particularly from its demand for goods and services), but which are physically produced by the activities of another organisation. Examples of indirect emissions include*

- *consumption of purchased electricity.*
- *upstream emissions generated in the extraction and production of fossil fuels.*
- *downstream emissions from transport of an organisation's product to customers.*
- *emissions from contracted/outsourced activities.*

On the basis of the above definitions, the NGAF workbook prescribes a range of emission factors to estimate associated GHG emissions. These emissions factors are activity-specific, with the scope of the activity determining the emission factor used. Specifically, the scope that emissions are reported under is determined by whether the activity is within the organisational boundary (direct—Scope 1) or outside it (indirect—Scope 2 and Scope 3). The NGAF workbook defines the scope of emissions through the following:

- **Direct** (or point-source) emission factors give the kilograms of carbon dioxide equivalent ($CO_{2\text{-}e}$) emitted per unit of activity at the point of emission release (i.e. fuel use, energy use, manufacturing process activity, mining activity, on-site waste disposal, etc.). These factors are used to calculate Scope 1 emissions.
- **Indirect** emission factors are used to calculate Scope 2 emissions from the generation of the electricity purchased and consumed by an organisation as kilograms of CO2-e per unit of electricity consumed. Scope 2 emissions are physically produced by the burning of fuels (coal, natural gas, etc.) at the power station.
- Various emission factors can be used to calculate Scope 3 emissions. For ease of use, the NGAF workbook reports specific scope 3 emission factors for organisations that:
  - burn fossil fuels: to estimate their indirect emissions attributable to the extraction, production and transport of those fuels; or
  - consume purchased electricity: to estimate their indirect emissions from the extraction, production and transport of fuel burned at generation and the indirect emissions attributable to the electricity lost in delivery in the transmission and distribution network.

11.4 Emission sources

The direct (Scope 1) and indirect (Scope 2 and Scope 3) emission sources defined for the Balranald Project and are shown in **Table 27**. The emission sources listed in **Table 27** represent the most significant GHGs associated with the Balranald Project. Other minor sources of GHG emissions, such as those generated by waste disposal and fugitive leaks from high voltage switch gear, are anticipated to be relatively negligible in comparison and have not been considered further in this assessment.

Table 27. Scope 1, 2 and 3 emission sources

Scope 1 (Direct)	Scope 2 (Indirect)	Scope 3 (Indirect)
Fuel combustion on site (diesel fuel and Liquefied Petroleum Gas (LPG))	Consumption of purchased electricity	Upstream emissions generated from supply of raw materials Downstream emissions generated from off-site transportation of product Employee travel

11.5 Reporting of GHG

Annual emissions for the following GHGs are presented:

- CO_2.
- CH_4.
- N_2O.

The relative importance of a GHG is measured in terms of its Global Warming Potential (GWP). The GWP is an index used to convert relevant non-CO_2 gases to a carbon dioxide equivalent (CO_2-e) by multiplying the quantity of the gas by its GWP. The GWP for each type of GHG has been taken from the NGAF workbook, as follows:

- CH_4: GWP of 21 (21 times more effective as a GHG than CO2).
- N_2O: GWP of 310 (310 times more effective as a GHG than CO2).

Emissions from each of the assessed GHGs have been reported in units of tonnes of carbon dioxide equivalents (t CO_2-e).

It is to be noted that while the Balranald Project would utilise processing and transport facilities in Victoria, this assessment quantifies direct and indirect GHG emissions for sources associated with operations and transport in NSW only.

11.6 Operational details

GHG emissions generated by the Balranald Project have been estimated for each year of mining operations (Year 1 through to Year 8). Extractive operations are planned to scale back in Year 9 as rehabilitation occurs. Consequently, Year 1 to Year 8 represent the peak years for potential GHG emissions from the Balranald Project. The indicative activity data for each year are presented in **Table 28**.

Table 28. Indicative annual production and activity data

Operational Year	Material produced (Mt)		Diesel consumption (kL)	LPG consumption (kL)	Electricity consumed (MWh)
	HMC	Ilmenite			
Year 1	0.21	0.23	16,687	11,053	77,000
Year 2	0.48	0.51	18,449	11,053	77,000
Year 3	0.61	0.64	23,034	11,053	77,000
Year 4	0.48	0.52	24,820	11,053	77,000
Year 5	0.53	0.56	25,361	11,053	77,000
Year 6	0.47	0.49	23,893	11,053	77,000
Year 7	0.51	0.5	26,018	11,053	77,000
Year 8	0.55	0.55	25,239	11,053	77,000

11.7 Scope 1 emissions

The principal use of diesel fuel during the life of the Balranald Project is for mobile mining equipment. There are no significant stationary sources of diesel fuel combustion in the project area. LPG fuel is specifically used for operation of the ISP.

Emissions from fuel consumption have been calculated based on equation provided in the NGAF workbook, as follows:

$$GHG\ Emissions_{fuel} = (Fuel\ Quantity \times Energy\ Content) \times (Emission\ Factor) / 1000$$

Where:

GHG Emissions $_{fuel}$ is the emissions attributed to a particular GHG (CO_2, CH_4 or N_2O), in tonnes of carbon dioxide equivalent (t CO_2-e), due to the combustion of a particular fuel.

Fuel Quantity is the quantity of fuel combusted in one year, (kL/year) as shown in **Table 28**

Energy Content is the energy content of the fuel combusted, (GJ/kL).

Emission Factor is the GHG emission factor (kg CO_2-e/GJ) for the relevant GHG (CO_2, CH_4 or N_2O), emitted due to fuel combustion.

Table 29 shows the energy content and GHG emission factor for diesel and LPG fuel.

Table 29. Fuel energy content and emission factors				
Types of fuel combusted (Stationary and Non-Stationary)	Energy content factor (GJ/kL)	Emission factor for fuel combustion (kg CO_2-e/GJ)		
		CO_2	CH_4	N_2O
Diesel	38.6	69.2	0.1	0.2
LPG	25.7	59.6	0.1	0.2

The estimated annual Scope 1 GHG emissions (t CO_2-e/year) from the combustion of diesel and LPG are presented in **Table 30**.

Table 30. Estimated annual Scope 1 GHG emissions	
Mine Year	**Emissions (t CO_2-e/year) for fuel combustion (Diesel and LPG)**
Year 1	61,782
Year 2	66,508
Year 3	78,809
Year 4	83,601
Year 5	85,052
Year 6	81,113
Year 7	86,813
Year 8	84,724

11.8 Scope 2 emissions

Scope 2 emissions from consumption of purchased electricity are quantified as follows:

$$GHG\ Emissions_{purchased\ electricity} = Amount\ of\ electricity\ purchased \times Emission\ factor / 1000$$

Where:

GHG Emissions $_{purchased\ electricity}$ is the total amount of GHG emitted t CO_2-e/year

Amount of electricity purchased refers to the amount of electricity purchased from the grid annually (kWh/year) as shown in **Table 28**

Emission factor, factor applicable for estimating emissions from purchase of electricity (kg CO_2–e/ kWh). This emission factor is based on geographic location within Australia from where the electricity is purchased and for NSW in 2014 is 0.86 kg CO_2–e/ kWh.

The estimated electricity consumption for the Balranald Project is approximately 77,000 MWh each year which results in annual Scope 2 GHG emissions of approximately 66,220 t CO_2-e/year.

11.9 Scope 3 emissions - upstream

The upstream activities that contribute to Scope 3 emissions include the production and supply of fuel (diesel and LPG) and emissions from purchased electricity associated with the extraction, production and transport of fuel burned at the point of electricity generation and the indirect emissions attributable to the electricity lost in delivery.

Scope 3 emissions for fuel and electricity consumption are quantified in the same way as Scope 1 emissions, however the emission factors differ and are presented in **Table 31**.

Table 31. Emission factor for Scope 3 emissions from consumption of fuel

Diesel	5.3 (kg CO_2-e/GJ)
LPG	5.0 (kg CO_2-e/GJ)
Electricity purchased in NSW	0.18 (kg CO_2-e/kWh)

11.10 Scope 3 emissions - downstream

Downstream emissions are estimated for the transportation of product to international markets. In estimating GHG emissions from transportation, the following assumptions are made:

- Ilmenite product will be transported by truck to Manangatang, Victoria and then by rail onto the Port of Melbourne for export.
- HMC will be transported by road truck to Hopetoun, Victoria and then transported by rail to the Hamilton mineral separation plant (MSP) for further processing. Rutile and Zircon (produced at the MSP) will be transported to Port of Melbourne via rail. Some by-products from the MSP will be returned to the project area, however for the purposes of GHG emission estimation, it is assumed that waste transportation is included in the return trip estimates.
- Products are produced entirely for export purpose, with all products exported from the Port of Melbourne to major ports in UK, USA, India and China. While Port of Melbourne, Port of Geelong and Port of Portland are all being considered as potential export ports, Port of Melbourne has been assumed for GHG estimation.
- Table 32 outlines the break-down of international destinations, assumed for the purposes of emission estimation. To be conservative, the highest percentage of product is assumed to travel to the UK and USA, as they are the farthest from Port Melbourne.

Table 32. Assumed break-down of product export internationally			
Product name	**Destination**	**Percentage (%) of product exported**	**Distance from Port of Melbourne (km) (one-way)**
Ilmenite	UK	30	11,035
	USA	30	9,464
	India	20	5,626
	China	20	5,131
Rutile and Zircon (produced at Hamilton MSP)	UK	30	11,035
	USA	30	9,464
	India	20	5,626
	China	20	5,131

11.10.1 Emissions from road transport

Emissions for road transportation have been calculated as follows:

$$GHG\ Emissions_{road\ transport} = (Fuel\ Quantity \times Energy\ Content) \times (Emission\ Factor) / 1000$$

Where:

GHG Emissions $_{road\ transport}$ is the emissions in t CO_2-e due to road transportation

Fuel Quantity is the quantity of fuel combusted by haul trucks annually (kL/yr)

Energy Content is the energy content of the fuel combusted, (GJ/kL).

Emission Factor is the GHG emission factor (kg CO_2-e/GJ) for relevant fuel consumed

The quantity of fuel has been estimated based on the amount of product transported annually off-site, a payload capacity of 40 tonnes per truck, the return-trip distance travelled for transportation and standard fuel consumption rate for haul trucks. **Table 33** shows the energy content and GHG emission factor for diesel-fuelled haul trucks.

Table 33. Fuel energy content and emission factor for road transport via haul trucks		
Fuel type	**Energy content factor (GJ/kL)**	**Emission factor (kg CO_2-e/GJ)**
Diesel	38.6	69.9

11.10.2 Emissions from rail transportation

GHG emissions from rail transportation are derived based on an annual tonne-kilometre (tonne-km), determined by multiplying the total rail distance travelled by the corresponding total amount of materials transported by rail each year.

The estimated tonne-kilometre was then multiplied by the GHG indicator for freight rail activity of 20g CO_2/tonne-km, obtained from the AGO National GHG Inventory, to estimate downstream emissions from rail transport.

$$GHG\ Emissions_{Rail\ Transport} = (Distance \times Maximum\ amount\ of\ material) \times (GHG\ indicator_{Rail\ Transport}) / 1{,}000{,}000$$

Where:

GHG Emissions $_{Rail\ Transport}$ is the emissions in t CO_2-e

Distance (km) is the distance between rail loading terminals and the Port of Melbourne

Maximum amount of material (tonne /year) is the amount of materials transported per year via freight trains to specific destinations

GHG indicator $_{Rail\ Transport}$ is the GHG indicator for freight rail activity: 20g CO_2/tonne-km

11.10.3 Emissions from shipping

GHG emissions from shipping are derived based on an annual tonne-km, determined by multiplying the distance of travel from the Port of Melbourne to identified overseas destinations by the corresponding amount of product transported via bulk carriers each year.

The estimated tonne-kilometre was then multiplied by a total efficiency factor (g CO_2/tonne-km) obtained from the IMO-GHG Study to estimate downstream emissions from bulk carrier transport. It is assumed that Panamax cargo ships with an average payload capacity of 74,000 tonnes would be used with a corresponding total efficiency factor of 4.1g CO_2/tonne-km. Emissions are derived as follows:

$$GHG\ Emissions_{Bulk\ Carrier\ Transport} = (Weighted\ average\ distance \times Average\ Cargo\ Capacity \times Max\ number\ of\ trips\ per\ year) \times (Total\ efficiency\ factor_{Bulk\ Carriers}) / 1{,}000{,}000$$

Where:

GHG Emissions $_{Bulk\ Carrier\ Transport}$ is the emissions in t CO_2-e

Weighted average distance is the distance (km) based on breakdown of amount of product shipped to a specific destination and the corresponding distance between the port and the destination (refer **Table 32**)

Average cargo capacity: Average cargo capacity of a Panamax bulk carrier in which the products would be shipped (74,000 tonnes)

Total efficiency factor $_{Bulk\ Carriers}$ *is* the GHG efficiency factor for bulk carrier activity, based on cargo capacity: 4.1g CO_2/tonne-km

11.11 Scope 3 emissions – employee travel

Scope 3 emissions from employee travel are estimated based on the following assumptions:

- During any given operational year, the estimated number of site personnel (employees, contractors and support staff) is approximately 255.
- Accommodation for site personnel is to be provided at an accommodation facility either at the project area or in the town of Balranald.
- 54% of the total site personnel would be transported daily by a diesel-fuelled coach bus with a 65 seat capacity.
- The remaining workforce would commute using their own transport (one gasoline fuelled light motor vehicle per person).
- Between Year 1 and Year 6 the majority of the operational activities are concentrated at the West Balranald mine. A one-way distance of 25 km is assumed to account for the movement of personnel between the accommodation facility (location assumed to be in Balranald twon, which results in the longest commute) and the West Balranald mine.
- In addition to extractive operations at West Balranald mine, operations at the Nepean mine commence from Year 6 onwards. To account for the transportation of personnel to both the West Balranald and Nepean mines, a one-way distance of 50 km has been assumed.

Emissions have been calculated as follows:

$$GHG\ Emissions_{personnel\ travel} = (Fuel\ Quantity \times Energy\ Content) \times (Emission\ Factor)$$

Where:

GHG Emissions $_{off\text{-}site\ transport}$ is the emissions in t CO_2-e
Fuel Quantity is the quantity of fuel consumed in off-site personnel transport (kL/year)

Energy Content is the energy content for fuel consumed, (GJ/kL)

Emission Factor is the GHG emission factor (kg CO_2 –e/ GJ) for relevant fuel consumed

Table 34 shows the energy content and GHG emission factor for site personnel travel.

Table 34. Fuel energy content and emission factor for personnel travel

Mode of transport	Fuel type	Energy content factor (GJ/kL)	Emission factor (kg CO_2-e/GJ)
Coach	Diesel	38.6	69.9
Light motor vehicle (car)	Gasoline	34.2	69.6

The estimated Scope 3 emissions for the Balranald Project are presented in **Table 35**. A summary of the combined Scope 1, 2 and 3 emissions and the total GHG emissions for each mine year from Year 1 to Year 8 are presented in **Table 36**.

Table 35. Calculated annual Scope 3 GHG emissions

Mine year	Scope 3 Emissions (t CO_2-e/year) by source					
	Upstream emissions		Downstream emissions - domestic transport		Downstream emissions - transport to international market	Employee travel
	Electricity consumption	Fuel supply (Diesel and LPG)	Emissions from road transport	Emissions from rail transport		
Year 1	10,010	6,708	5,327	8,687	164,712	1,053
Year 2	10,010	7,068	12,139	19,879	378,315	1,053
Year 3	10,010	8,006	15,257	24,787	468,978	1,053
Year 4	10,010	8,372	12,259	20,064	381,638	1,053
Year 5	10,010	8,482	13,344	21,990	420,561	1,053
Year 6	10,010	8,182	11,738	19,294	368,347	1,053
Year 7	10,010	8,616	12,562	20,331	384,012	2,107
Year 8	10,010	8,457	13,597	22,085	418,188	2,107

Table 36. Calculated annual GHG emissions – all scopes

Mine year	Annual GHG emissions (t CO_2-e/year) by scope			Total annual GHG emissions (tCO_2-e/year)
	Scope 1	Scope 2	Scope 3	
Year 1	61,782	66,220	196,498	324,500
Year 2	66,508	66,220	428,465	561,193
Year 3	78,809	66,220	528,092	673,121
Year 4	83,601	66,220	433,395	583,216
Year 5	85,052	66,220	475,440	626,713
Year 6	81,113	66,220	418,625	565,958
Year 7	86,813	66,220	437,344	586,521
Year 8	84,724	66,220	474,444	625,388

11.12 Impacts of GHG Emissions on the Environment

The extent of the warming produced by a given rise in GHG concentrations depends on 'feedback' processes in the climate system, which can either amplify or dampen a change (CSIRO, 2011, p.15). According to the CSIRO (2011) the net effect of all climate feedbacks, given global GHG emissions, is to amplify the warming caused by increasing CO_2 and other GHGs of human origin. The best estimate of annual average warming by 2030 (above 1990 temperatures) is given as being around 1.0ºC across Australia, with warming of 0.7°C to 0.9ºC in coastal areas and 1°C to 1.2ºC inland (CSIRO, 2011, p. 35). In regard to rainfall, the CSIRO notes that drying is likely in southern areas of Australia, especially in winter, and in southern and eastern areas in spring. This is due to a contraction in the rainfall belt towards the higher latitudes of the southern hemisphere. More extreme rainfall events are predicted for most locations, with the drying and increased evaporation resulting in a decline in soil moisture over parts of Australia. An increase in fire-weather risk is given as being likely with warmer and drier conditions (CSIRO, 2011).

Potential environmental effects in Australia associated with climate change due to global GHG emissions, are documented to include loss of biodiversity, water security issues in parts of Australia, increased drought and fire incidents, and risks of sea level rise and coastal flooding (IPCC, 2007).

Given the complexity of climate feedback processes, the non-linear relationship between GHG emissions and climate changes, and uncertainties in climate change projections, the specific impact of GHG emissions from the Balranald Project on the climate system, and as a consequence the broader environment, cannot be quantified with any certainty. The relative significance of GHG emissions from the Balranald Project may however be qualitatively evaluated by considering the magnitude of such emissions compared to total GHG emissions released within NSW, nationally and globally.

The most recently published annual GHG emissions for NSW and Australia have been sourced from the online National Greenhouse Gas inventory – Australian Greenhouse Emissions Information System (AGEIS) (http://ageis.climatechange.gov.au/).

The 2012 annual GHG emissions for NSW and Australia were 154.7 Mt and 554.6 Mt CO_2-e/yr respectively. Global annual GHG emissions for 2010 totalled 49,000 Mt according to the Climate Change 2014: Synthesis Report, compiled by the Intergovernmental Panel on Climate Change (IPCC, 2014). At the time of undertaking this assessment, this estimate comprised the latest global GHG emissions data available.

The significance of Project-related GHG emissions in comparison to NSW, Australian and global annual GHG emissions is presented in **Table 37**. Emissions have been compared in terms of GHG emissions directly generated by the operation of the Balranald Project (Scope 1) and beyond the operational boundary of the Balranald Project (Scope 2 and Scope 3). Further, in comparing Project GHG emissions with NSW and Australian annual totals, only emissions generated in Australia have been incorporated into calculations. Downstream emissions generated from off-shore product transport to the international market have been included in the comparison with global emissions only.

It can be seen from the results presented within **Table 37** that direct emissions (Scope 1) generated by the Balranald Project represent between 0.04% and 0.055% of annual NSW emissions, 0.011% to 0.015% of Australian emissions and between 0.00013% and

0.00017% of global emissions. Similarly, indirect emissions (Scope 2 and Scope 3) represent between 0.063% and 0.081% of annual NSW emissions, 0.018% to 0.023% of Australian emissions and between 0.0005% and 0.0012% of global emissions. It is noted that emissions from off-shore product transport have not been considered for determining the impact of indirect emissions on NSW and Australian GHG emissions.

Table 37. Comparison of annual project GHG emissions with NSW and Australia (2009-10) and global (2004) GHG emissions

Mine Year	Significance of direct project emissions (Scope 1)			Significance of indirect project emissions (Scope 2 and Scope 3)		
	vs NSW	vs Australia	vs Global	vs NSW	vs Australia	vs Global
Year 1	0.040%	0.011%	0.00013%	0.063%	0.018%	0.0005%
Year 2	0.043%	0.012%	0.00014%	0.075%	0.021%	0.0010%
Year 3	0.051%	0.014%	0.00016%	0.081%	0.023%	0.0012%
Year 4	0.054%	0.015%	0.00017%	0.076%	0.021%	0.0010%
Year 5	0.055%	0.015%	0.00017%	0.078%	0.022%	0.0011%
Year 6	0.052%	0.015%	0.00017%	0.075%	0.021%	0.0010%
Year 7	0.054%	0.015%	0.00017%	0.077%	0.022%	0.0010%
Year 8	0.055%	0.015%	0.00017%	0.079%	0.022%	0.0011%

11.13 Greenhouse Gas Mitigation Measures

The following provides a discussion of the potential mitigation measures and strategies that could be implemented by Iluka to reduce both direct and indirect GHG emissions from the Balranald Project.

11.13.1 Direct Emissions (Scope 1)

For the Balranald Project, the only identified source of direct emissions is the consumption of diesel fuel by mobile plant and equipment and consumption of LPG fuel by the ISP.

For minimising direct emissions, the following recommendations are made:

- Use mining equipment which is regularly maintained and serviced to maximise efficiency.
- Proper maintenance of fixed plant and equipment to maximise efficiency.
- Use of lower emission fuels (biodiesel, natural gas) where practical.
- Reduce fuel consumption by minimising the vehicle kilometres travelled on site.
- Plan operations well in advance in order to minimise resource non-utilisation and waste.

11.13.2 Indirect Emissions (Scope 2 and Scope 3)

Indirect emissions (Scope 2 and Scope 3) contribute, on an average, approximately 85% of annual Project GHG emissions based on emissions estimated from Year 1 to Year 8. Of the indirect emissions, the major contributions are from downstream product transport to the international market, which constitutes approximately 80% of indirect emissions (Scope 2 and Scope 3) for the Balranald Project. The remaining contributors to indirect emissions are: electricity consumption (Scope 2 and Scope 3), diesel and LPG fuel upstream emissions, domestic downstream emissions for product transportation via road / rail network and personnel commuting.

The following recommendations are made for indirect emission reductions:

- Adopt the use of energy efficient lighting technologies and hot water and air conditioning systems wherever practical.
- Use of alternative energy sources where practical such as solar power and green power.
- Progressively review and implement energy efficiency measures throughout the life of the Balranald Project.
- Undertaking awareness and training programs on energy efficiency measures for site personnel.
- Conduct periodic audits and reviews on the amounts of materials used, amount of mine waste and non-mine waste generated and disposed.
- Source materials locally where feasible to minimise emissions generated from upstream activities.

12 Conclusion

12.1 Air quality assessment

TSP, PM_{10} and $PM_{2.5}$ emissions were quantified and modelled for Year 1, Year 4 and Year 7 conceptual mine plans to assess the potential for and spatial variation of air quality impacts on the surrounding environment. The predicted ground level concentrations and dust deposition rates associated with all mining years assessed were predicted to be within EPA impact assessment criteria for all assessment locations and all years.

Similarly, trace metal/ metalloid and RCS concentrations predicted due to the Balranald Project were concluded to be in compliance with relevant impact assessment criteria across all years assessed.

Generally, the predictions presented in this report incorporate a level of conservatism due to worst case assumptions and the inherent conservative nature of dispersion modelling. As a result, it is expected that actual ground level concentrations would be lower during the normal operation of the Balranald Project.

A proposed monitoring program takes into account the predicted low risk from the Balranald Project and consistent with similar operations in NSW.

12.2 Greenhouse gas assessment

To evaluate the Project's GHG emissions and determine the Project's contributions to NSW and Australian GHG emissions, emissions were estimated based on available information and relevant GHG emission factors. The relative significance of GHG emissions from the Balranald Project is qualitatively evaluated by considering the magnitude of such emissions compared to total GHG emissions released within NSW, nationally and globally.

The key findings of the assessment are as follows:

- Annual Project GHG emissions calculated from Year 1 to Year 8 (from direct and indirect emissions) were estimated to be between 0.3 Mt and 0.6 Mt of CO2-e/yr.
- Indirect emissions (Scope 2 and Scope 3) are the major contributors of the Project's GHG emissions.
- Of the indirect emissions, downstream product transport to the international market on average accounts for 80% of indirect emissions.
- Direct emissions generated by the Project represent between 0.04% and 0.055% of total annual NSW emissions, 0.011% to 0.015% of Australian emissions and between 0.00013% and 0.00017% of global emissions.
- Indirect emissions generated by the Project represent between 0.063% and 0.081% of annual NSW emissions, 0.018% to 0.023% of Australian emissions and between 0.0005% and 0.0012% of global emissions.

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Appendix A

Private Dwelling Locations

Assessment location	Location (m, MGA54)		Assessment location	Location (m, MGA54)	
	Easting	Northing		Easting	Northing
R1	696886	6246612	R36	732569	6182762
R2	727253	6197483	R40	729735	6166498
R5	720457	6188284	R41	729416	6166705
R7	737625	6180476	R45	740323	6176723
R9	740150	6189570	R54	738333	6172592
R10	740125	6189461	R57	737115	6170323
R11	725618	6222584	R59	724973	6158233
R12	724083	6221740	R60	724956	6158998
R13	716916	6217832	R62	744384	6192561
R14	689741	6242038	R63	744420	6192527
R15	726161	6244632	R77	745921	6185516
R16	753307	6249232	R80	739731	6187399
R18	732065	6222055	R85	742428	6184213
R19	714568	6206861	R88	742456	6184448
R20	706863	6190759	R92	736181	6182610
R21	690402	6200976	R95	737707	6180611
R22	690346	6200894	R108	740344	6173973
R24	741313	6178438	R114	750037	6174921
R25	743461	6180042	R126	748926	6171911
R26	743538	6191196	R127	751051	6169606
R27	745203	6187369	R132	748647	6170603
R28	745668	6185560	R133	748194	6170593
R29	737669	6243255	R134	748368	6170669
R30	737486	6250428	R151	734182	6165100
R31	731673	6231434	R153	734079	6164978
R32	720745	6213679	R162	735524	6166108
R168	738017	6163472	R229	733111	6164245
R170	737121	6163269	R230	733107	6164225
R171	737065	6163200	R240	733230	6161856
R174	736306	6163583	R242	734824	6162055
R175	736789	6163254	R244	734948	6161810
R177	736827	6163490	R245	734934	6161833
R192	734024	6164931	R246	734908	6161885
R193	734061	6164960	R250	734894	6161917
R194	733941	6164898	R256	736680	6161223
R195	733981	6164885	R258	735434	6161801
R197	733916	6164790	R260	735375	6161900
R200	733406	6164720	R266	735093	6160837
R202	733290	6164651	R268	732861	6159941

Assessment location	Location (m, MGA54)		Assessment location	Location (m, MGA54)	
	Easting	Northing		Easting	Northing
R203	733326	6164573	R276	730802	6181794
R208	733207	6164508	R277	731164	6182572
R213	733307	6164450	R281	731964	6175482
R217	733195	6164266	R284	732598	6165070
R219	733228	6164234	R287	730927	6163301
R220	733205	6164234	R291	729807	6162929
R221	733167	6164228	R297	731986	6164271
R222	733149	6164231	R300	732985	6164048
R223	733127	6164233	R303	731242	6163308
R224	733092	6164295	R307	731695	6163779
R225	733114	6164290	R310	731667	6163841
R226	733136	6164282	R316	730355	6162981
R227	733153	6164278	R319	720240	6162302
R228	733175	6164275	R321	732709	6162600
R322	732664	6162489	R415	732122	6222195
R323	732765	6162580	R419	723971	6221765
R329	731455	6160287	R421	731547	6231530
R331	728969	6158678	R422	731701	6231465
R334	728333	6158991	R423	731725	6231435
R336	727911	6158504	R424	731652	6231431
R342	713450	6157815	R425	731536	6231427
R343	713585	6157712	R426	731637	6231461
R351	729716	6161297	R427	731644	6231448
R353	706811	6190856	R433	750848	6206579
R357	706663	6190786	R437	749050	6217852
R362	712896	6188906	R445	748623	6217710
R366	713659	6177745	R455	748212	6230933
R369	700212	6171643	R470	751812	6244184
R370	698819	6167512	R478	753792	6249167
R375	698944	6167595	R479	747507	6249579
R376	698877	6167686	R485	736387	6249889
R378	698445	6167463	R488	728673	6249366
R380	703026	6165588	R489	697053	6246579
R386	703202	6165543	R492	696819	6246744
R389	706440	6161200	R496	696920	6246612
R393	714056	6159923	R508	755860	6192441
R402	727155	6197495	R509	755892	6192296
R403	727064	6197495	R510	756105	6192214
R405	727771	6197280	R511	755979	6192380
R406	720716	6213873	R516	752184	6170244

Assessment location	Location (m, MGA54)		Assessment location	Location (m, MGA54)	
	Easting	Northing		Easting	Northing
R414	732081	6222100	R525	752485	6164462
R554	687549	6165153	R648	696896	6155884
R556	687569	6163517	R651	697372	6156408
R557	687694	6163592	R652	697669	6156549
R559	687826	6163719	R654	697607	6156537
R564	692131	6158095	R658	697410	6156151
R569	686806	6158018	R659	698106	6156131
R571	685949	6157393	R660	698055	6156278
R579	684989	6157418	R665	698056	6156363
R584	686208	6156927	R666	698175	6157033
R594	696013	6156439	R667	698117	6156791
R598	696301	6156214	R675	698782	6155720
R600	696517	6156403	R676	698504	6155865
R602	696695	6156411	R677	698353	6155916
R614	696873	6156338	R678	698378	6155864
R616	696829	6156364	R681	698915	6155274
R621	696856	6156193	R682	699000	6155050
R622	696911	6156324	R684	699080	6155207
R624	696873	6156338	R685	699087	6155187
R626	696983	6156246	R686	699098	6155152
R637	697009	6156252	R687	699109	6155126
R638	697079	6156230	R688	699160	6155265
R640	697172	6156312	R690	700104	6155977
R641	697246	6156303	R691	700245	6155938
R643	697223	6156188	R694	699384	6156046
R644	697180	6156197	R695	699381	6156010
R645	697144	6156212	R697	699538	6155618
R646	697112	6156233	R701	699572	6155147
R703	699653	6155331	R816	706225	6149278
R714	704506	6156380	R817	706397	6149215
R716	710471	6155834	R821	706112	6149081
R717	710527	6155933	R822	705989	6149056
R722	717878	6155234	R823	705772	6149067
R724	718041	6154976	R829	705998	6149685
R726	721409	6156619	R830	705474	6149461
R732	735046	6155382	R835	702183	6149762
R735	738073	6156257	R836	698931	6149978
R736	737913	6156392	R837	696348	6149493
R745	738934	6155430	R838	696644	6149290
R751	749966	6154891	R839	696637	6149273

Assessment location	Location (m, MGA54)		Assessment location	Location (m, MGA54)	
	Easting	Northing		Easting	Northing
R754	749928	6154612	R840	696259	6148620
R757	731000	6153528	R841	696763	6148617
R760	715606	6154893	R842	696705	6148622
R767	698508	6154744	R843	696608	6148626
R768	698327	6154572	R845	704632	6148431
R771	693680	6154806	R850	705322	6147441
R772	692231	6154625	R851	705331	6148737
R777	686730	6154960	R852	706114	6147005
R778	685966	6154347	R854	706243	6148459
R781	685765	6154108	R855	706175	6148357
R794	687813	6152342	R857	706568	6148625
R796	688655	6152326	R861	713632	6148504
R807	753075	6149788	R862	713579	6148321
R811	734229	6149260	R865	714282	6147654
R815	711996	6149851	R866	715084	6147467
R867	715027	6147812	R930	713840	6141426
R875	734749	6147552	R931	713956	6141496
R876	734703	6147541	R935	714072	6141738
R877	755617	6148683	R938	713848	6141531
R881	751772	6146412	R940	713892	6141504
R885	713090	6145942	R943	714197	6141184
R887	712054	6146356	R946	711309	6142298
R888	707751	6146115	R957	706951	6141000
R889	688634	6144787	R962	705617	6142936
R890	688619	6144868	R968	700095	6142583
R891	688656	6144860	R969	688914	6140716
R892	688582	6144874	R970	688920	6140770
R893	694726	6143835	R971	695595	6138978
R894	694759	6143800	R972	695590	6138993
R895	694685	6143860	R976	713792	6140432
R896	694655	6143867	R988	713757	6139381
R897	694647	6143761	R989	713559	6139291
R898	694702	6143727	R999	714215	6139792
R899	706561	6144970	R1001	714551	6139742
R903	728620	6144257	R1008	746267	6139965
R906	730988	6141765	R1012	735804	6138958
R907	728391	6142623	R1017	713000	6138673
R912	721027	6142649	R1022	708477	6138373
R914	720849	6142707	R1027	708543	6138355
R919	721053	6141805	R1029	697340	6138828

Assessment location	Location (m, MGA54)		Assessment location	Location (m, MGA54)	
	Easting	Northing		Easting	Northing
R920	720925	6141942	R1030	697399	6138845
R928	713829	6142255	R1031	697439	6138844
R1032	697447	6138828	R1041	696156	6138307
R1033	697480	6138845	R1042	734536	6165202
R1034	697450	6138977	R1043	734397	6165219
R1035	697345	6138950	R1044	735704	6164370
R1036	696289	6138530	R1045	734947	6163688
R1037	696250	6138471	R1046	734670	6161558
R1038	696293	6138485	R1047	731278	6161647
R1039	696256	6138489	R1048	737870	6156421
R1040	696155	6138501			

Appendix B

Meteorological and dispersion modelling methodology

Overview of Meteorological and Dispersion Modelling Approach

As discussed in **Section** 5, no site-specific hourly meteorological monitoring data is available for the project area. The BoM climate station located at Balranald only records meteorological condition at 9am and 3pm and is therefore not suitable for air dispersion modelling purposes. The closest BoM AWS, capable of recording hourly average meteorological conditions, is Mildura Airport (Station number 76031), located more than 100 km from the Balranald Project.

Due to the lack of suitable site-specific monitoring data, meteorological modelling was undertaken to generate a dataset for the Balranald Project site to enable atmospheric dispersion modelling to be undertaken. Iterative meteorological modelling was conducted to identify the most suitable meteorological modelling method. It was determined that predictions derived from CSIRO's prognostic model TAPM could be improved through subsequent CALMET modelling with TAPM-generated 3 km-grid (spacing) data used as input to the CALMET modelling. Initially, CALMET was run in 'no-obs mode', i.e. excluding the input of any meteorological monitoring data. The output from the 'no-obs mode' modelling was found to under predict the frequency of calm winds and high winds, based on comparisons with hourly wind data from five regional Bureau of Meteorology automatic weather stations. Running CALMET in Hybrid mode by assimilating one year of meteorological data (2011) from the closest BoM station (Mildura Airport AWS), significantly improved calm wind and high wind period predictions.

Wind field data from the CALMET Hybrid mode runs were output for three locations within the project area to assess spatial variations in the wind field. These locations coincided with the middle of Nepean mine, the middle of West Balranald mine and midway between Nepean and West Balranald mines. Spatial variations in the wind field were found to be negligible over the Project area due to the flat terrain.

The USEPA regulatory AERMOD dispersion model was applied to simulate air quality impacts due to the Balranald Project. This model represents an advanced, 'new generation' model when compared to the Ausplume model developed by the Victorian EPA which has been extensively applied within NSW historically. AERMOD is applicable within flat and complex terrain environments, and is usually applied for meso-scale dispersion modelling (typically up to tens of kilometres). Complex wind models such as CALPUFF are applied for larger-scale, regional modelling specifically to account for spatial variations in the wind field. In the current assessment it was established based on CALMET meteorological modelling that spatial variations in the wind field are negligible across the project area thus justifying the use of the AERMOD model. The reduced complexity and faster run time of the AERMOD model, compared to CALPUFF, made it practical to model a greater number of scenarios without impacting on the accuracy of the model predictions. Furthermore, the AERMOD model is well suited to the simulation of mining emissions, with specific provision made for sources located within 'open pits'. CALMET Hybrid-mode meteorological output data was input into AERMOD.

More detailed information on the meteorological and dispersion modelling conducted for the Balranald Project is given in subsequent subsections.

B1. TAPM and CALMET Meteorological Modelling

The CSIRO's prognostic model TAPM was used to generate the meteorological parameters for the Balranald Project. TAPM outputs three-dimensional time-resolved meteorological data including wind speed and direction, temperature, pressure, water vapour, cloud, rain and turbulence. TAPM relies on region-specific data drawn from databases covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses to produce site-specific hourly meteorological observations at various heights above the ground.

TAPM v4.0 was configured for three model resolution levels, with grid cell resolution of 30km, 10km and 3km, centred over the project area. Each model resolution level was configured with 30 vertical grid levels and 49 by 49 horizontal grid points. Default land use and soil temperature databases were retained.

TAPM was configured to run for the period between 1 January 2011 and 31 December 2011 in order to obtain a full calendar year meteorological data. Model outputs were extracted for the 3km grid resolution level, for use as a three dimensional regional meteorological input dataset for CALMET modelling.

The CALMET meteorological model is a component of the USEPA approved CALPUFF dispersion model suite. The CALMET meteorological model develops wind and temperature fields on a three dimensional gridded modelling domain (Scire et al., 2000). Associated two-dimensional fields such as mixing height, surface characteristics, and dispersion properties are also included in the file produced by CALMET. The interpolated wind field is then modified within the model to account for the influences of topography, as well as differential heating and surface roughness associated with different land uses across the modelling domain. These modifications are applied to the winds at each grid point to develop a final wind field. The final wind field thus reflects regional airflow patterns in addition to the influences of local topography and land uses.

The CALMET model can integrate hourly average surface meteorological data as input, including wind speed, wind direction, mixing depth, cloud cover, temperature, relative humidity, pressure and precipitation. Additionally, CALMET can adopt concurrent upper air meteorological data containing similar parameters in order to calculate conditions at heights above ground level. The configuration of the CALMET model for application within the Balranald Project assessment is outlined in the table below.

Meteorological grid domain	SW corner (m, MGA54): Northing: 6140000 Easting: 661000 (240km x 240km domain)
Meteorological grid resolution	Horizontal grid resolution: 500 m
Vertical resolution (cell heights)	0m, 20m, 40m, 80m, 160m, 320m, 640m, 1200m, 2000km, 2500m, 3000m, 3500m
Modelling year	2011
Surface meteorological stations	No observations (No-obs mode) Mildura Airport AWS (Hybrid mode)
Upper air meteorological stations	TAPM 3-Dimensional Prognostic Dataset

Initially CALMET was configured using only Prognostic Model output data from TAPM, with no measured meteorological data input (No-obs mode). The output from CALMET No-obs runs was compared to hourly wind data from five BoM stations (refer to **Section 5.1** for a description of these stations and their locations). The CALMET (no-obs mode) predicted wind field was generally representative of the regional wind pattern though some BoM stations were located more than 200 kms away, indicating that the wind field is dominated by regional airflow patterns rather than local topography (**Figure B1** and **Figure B2**). The average measured wind speed varied across stations between 3.2 m/s to 4.3 m/s. CALMET (no-obs mode) generated wind fields were noted to under predict the frequency of calm wind conditions (i.e. periods less than 0.5 m/s) and high winds. CALMET was therefore re-run in Hybrid mode with 2011 meteorological data from the closest BoM station, Mildura Airport AWS, being input into the model as described below.

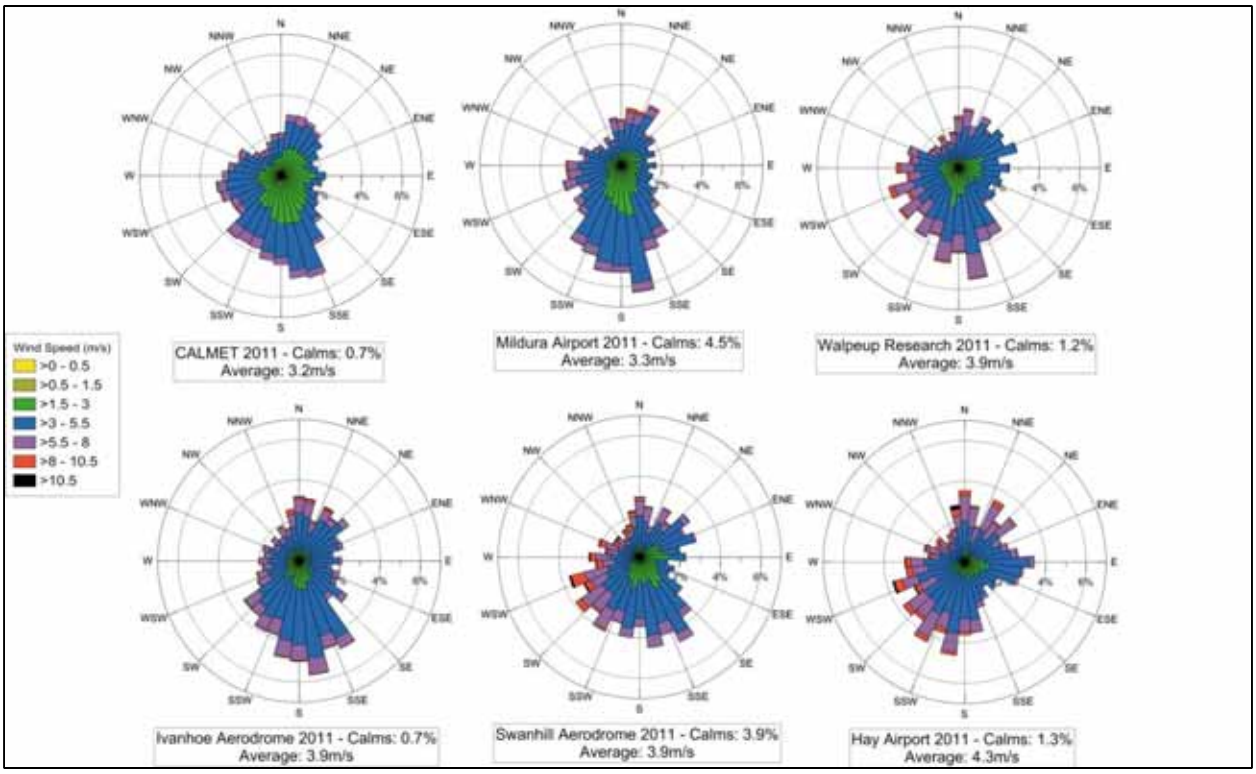

Figure B1. Wind Roses for CALMET (No-obs) and BoM AWS - 2011

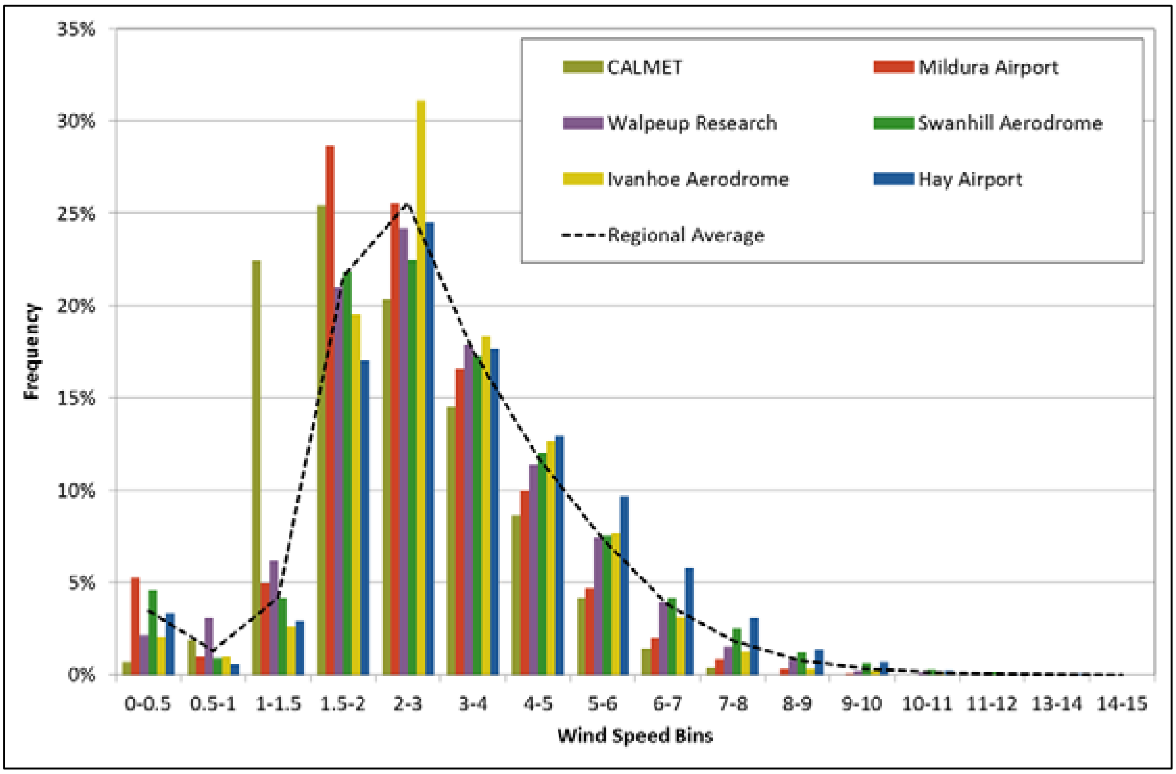

Figure B2. Wind Speed Comparison CALMET (No-obs) and BoM Stations – 2011
Note: Regional average calculated based on recorded wind field data at five BoM stations.

For the hybrid mode, CALMET was configured using a combination of Prognostic Model output data from TAPM and surface observations is in accordance with the Hybrid Mode configuration as specified within Table 2-1 of the Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the *'Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia*' (TRC Environmental, 2011).

The 2011 meteorological data set for Mildura Airport AWS was selected following the review of data completeness and inter-annual wind field analysis. Mildura Airport AWS data completeness for 2011 was found to be good, as illustrated in the table below. Missing data was substituted in accordance with USEPA (2000) (*Meteorological Monitoring Guidance for Regulatory Modelling Applications, February 2000*).

Data completeness for 2011 at Mildura Airport		
Parameters	**Hours of Data**	**Data Completeness**
Temperature	8720	99.5%
Precipitation	8590	98.1%
Pressure	8712	99.5%
Relative Humidity	8710	99.4%
Wind Direction	8720	99.5%
Wind Speed	8720	99.5%
Cloud cover	8760	100%
Ceiling Height	8760	100%

The 2011 meteorological data recorded at Mildura Airport AWS was found to be sufficiently representative of longer-term records (2007- 2012). Inter-annual trends in wind field recorded at Mildura Airport are compared in **Figure B3** and **Figure B4**. The region generally experiences predominant south-easterly to south-south-westerly flows with average winds in the range of 3.3m/s to 3.8m/s. Wind fields recorded in 2011 are generally comparable with wind patterns observed in other years. During 2011, the frequency of calms was about the average at 4.5% as compared to the range of 3.4% to 5.6%.

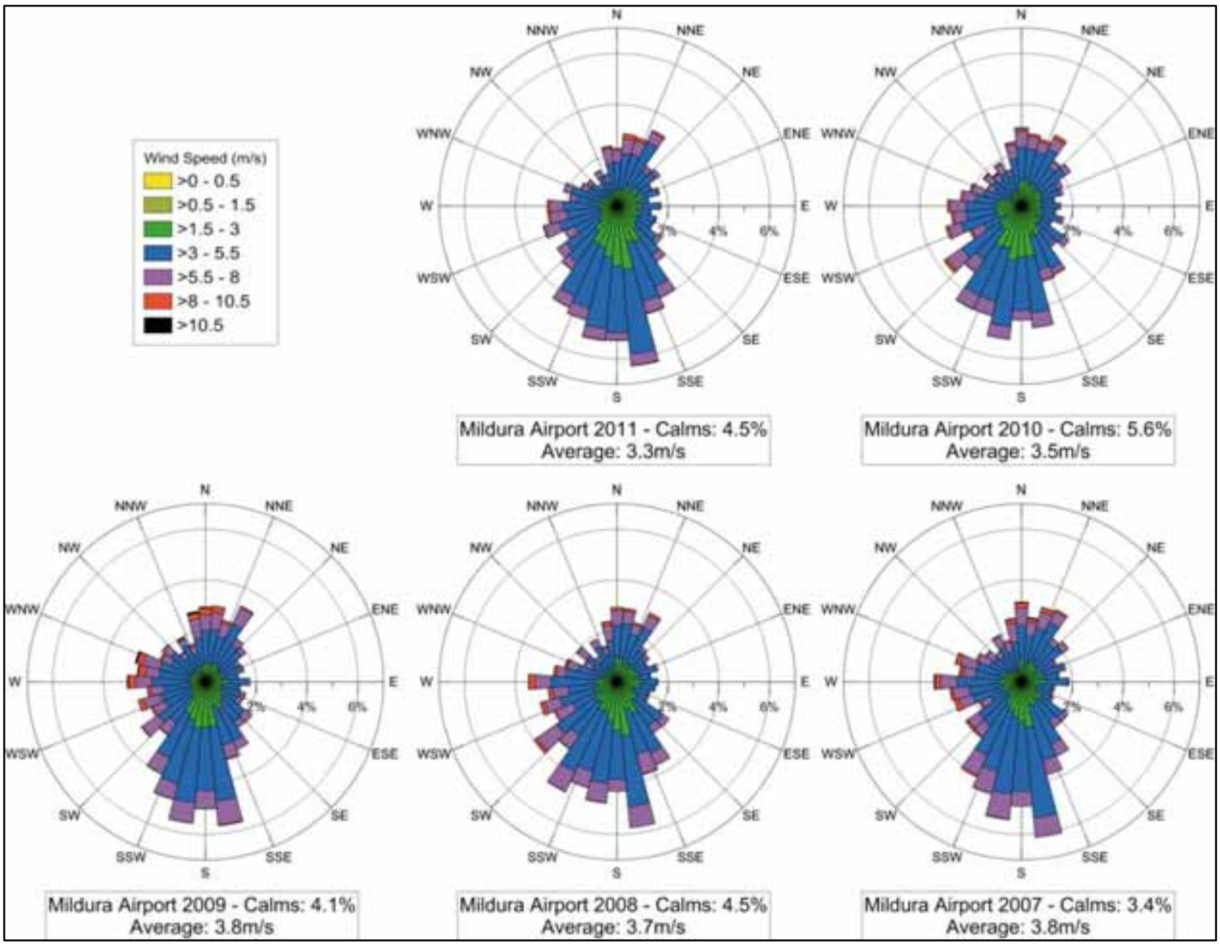

Figure B3. Inter-annual wind rose - Mildura Airport 2007-2011

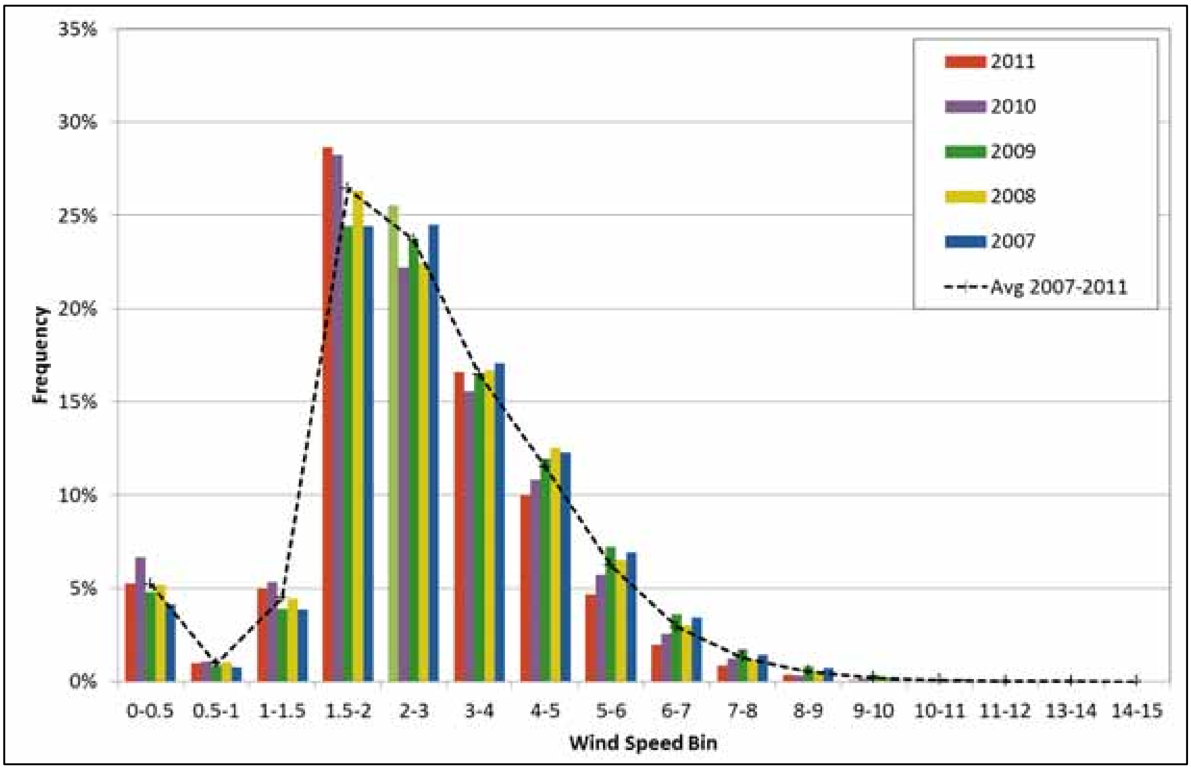

Figure B4. Inter-annual trends - wind speed ranges at Mildura

Wind fields generated by CALMET in hybrid mode for the Balranald Project site were comparable to recoded wind fields at Mildura Airport AWS (**Figure B5** and **Figure B6**), showing an improved wind field estimation.

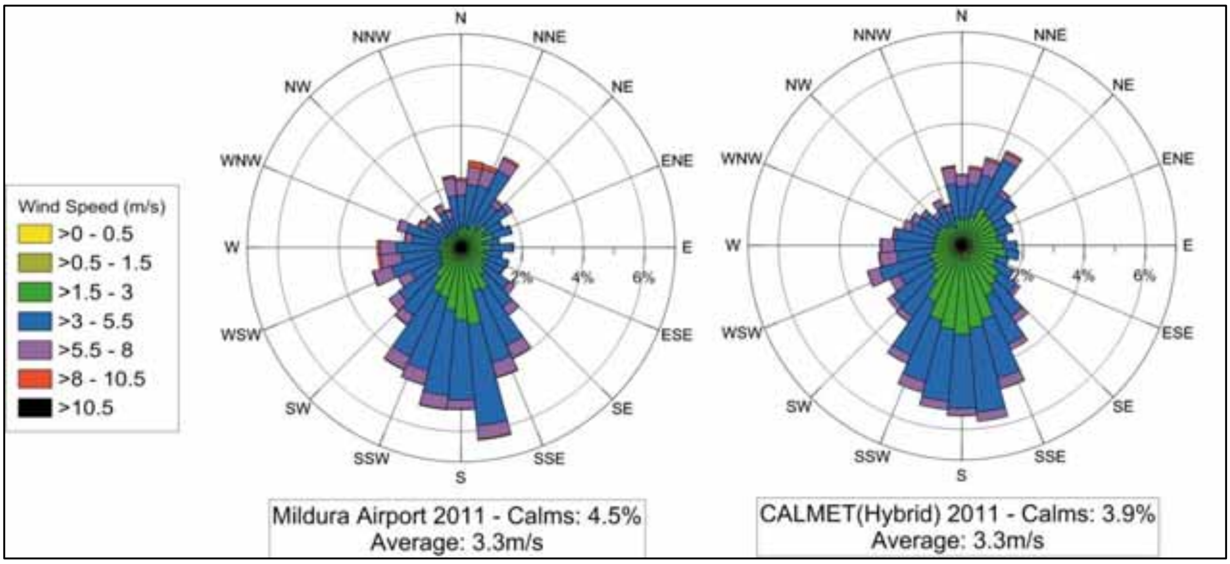

Figure B5. Wind Roses for BoM Mildura Airport AWS and for the Balranald Project site (based on CALMET hybrid model) – 2011

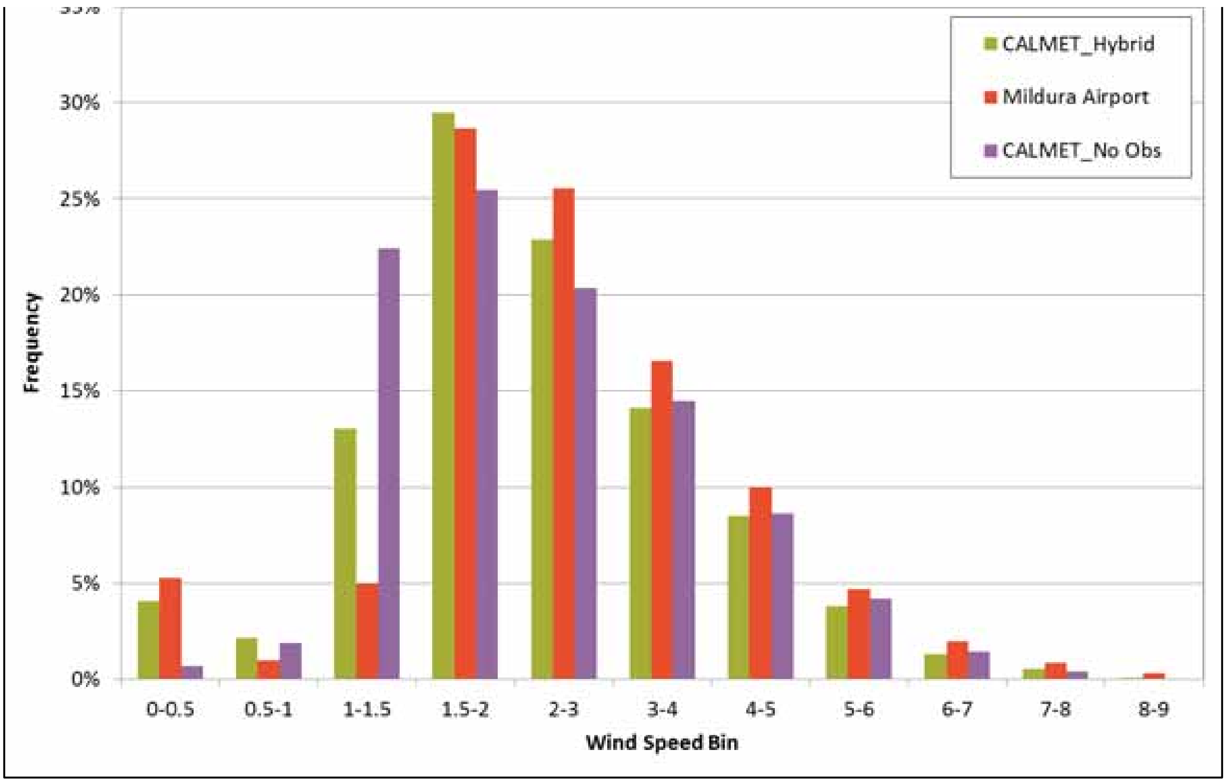

Figure B6. Frequency of wind speed ranges for Mildura Airport AWS and for the Balranald Project site (based on CALMET No-obs and CALMET hybrid runs) – 2011

Spatial Variation in Wind Field

Wind field data from the CALMET Hybrid mode runs were output for three locations within the project area to assess spatial variations in the wind field. These locations coincided with the middle of Nepean mine, the middle of West Balranald mine and midway between Nepean and West Balranald mines. Results are presented in **Figure B7** and **Figure B8**. Spatial variations in the wind field were found to be negligible over the Project area due to the flat terrain. This justified the use of the AERMOD dispersion model within the assessment.

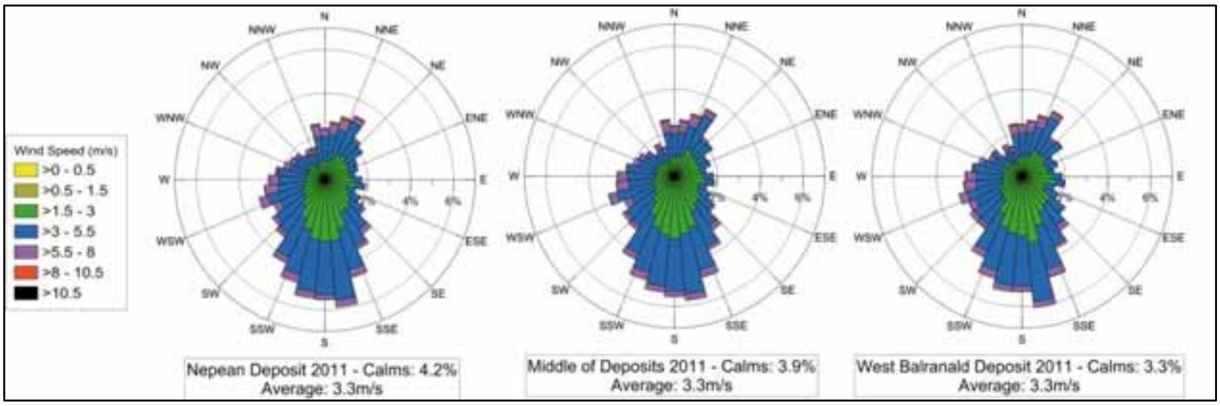

Figure B7. Wind rose spatial variation CALMET (Hybrid mode) – 2011

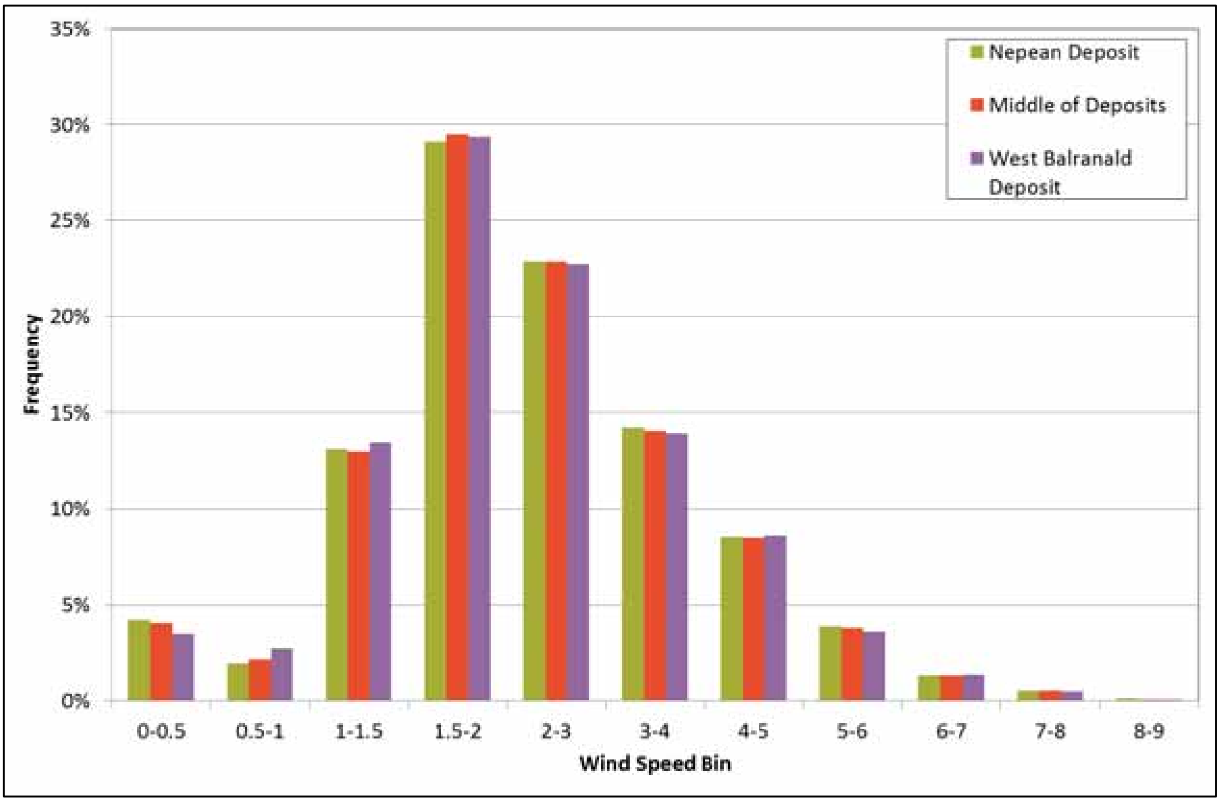

Figure B8. Wind speed bins spatial variation CALMET (Hybrid mode) – 2011

B2. AERMOD

AERMOD is the USEPA's recommended steady-state plume dispersion model for US regulatory purposes. AERMOD is designed to handle a variety of pollutant source types, including surface and buoyant elevated sources, in a wide variety of settings such as rural and urban as well as flat and complex terrain(6). AERMOD is able to predict pollutant concentrations from point, area and volume sources in addition to 'open pit' sources.

AERMOD replaced the Industrial Source Complex (ISC) model for regulatory purposes in the US in December 2006 as it provides more realistic results with concentrations that are generally lower and more representatives of actual concentrations compared to the conservative ISC model. Ausplume, a steady state Gaussian plume dispersion model developed by the Victorian EPA and frequently used in Australia for simple near-field applications, is largely based on the ISC model.

Compared to ISC and Ausplume, AERMOD represents an advanced new-generation model, which requires additional meteorological and land use inputs to provide more refined predictions. The most important feature of AERMOD, compared to ISC and Ausplume, is its modification of the basic dispersion model to account more effectively for a variety of meteorological factors and surface characteristics. In particular, it uses the Monin-Obukhov length scale rather than Pasquill-Gifford stability categories to account for the effects of atmospheric stratification. Whereas Ausplume and ISC parameterise dispersion based on

[6] Under complex wind conditions and for regional applications, CALPUFF is the USEPA's recommended model for regulatory purposes.

semi-empirical fits to field observations and meteorological extrapolations, AERMOD uses surface-layer and boundary layer theory for improved characterisation of the planetary boundary layer turbulence structure.

Verification studies have been undertaken for AERMOD both locally and abroad (Hanna et al 2001; Perry et al 2005; Hurley 2006). Hanna et al (2001) concluded that AERMOD performed better than ISC with predictions generally within a factor of two of actual values. It was noted that AERMOD did tend to under-predict actual concentrations by 20% to 40%, with predictions more accurate for short-term averaging periods. Perry et al (2005) summarises the performance of AERMOD across 17 field study databases placing emphasis on statistics that demonstrate the model's abilities to reproduce the upper end of the concentration distribution which are of importance in terms of regulatory modelling. The field studies include flat and complex terrain cases, urban and rural conditions and elevated and surface releases with and without building wake effects. Perry et al (2005) concluded that, with few exceptions, AERMOD's performance was superior to that of the other applied models tested.

Hurley (2006) compared the performance of Ausplume, AERMOD and TAPM across several case studies including flat terrain, flat terrain with building downwash, in complex terrain and coastal terrain. AERMOD was determined to perform acceptably for all of the datasets but was found unable to simulate shoreline fumigation in the case of the Kwinana case study. This potential limitation of AERMOD is not of relevance to the Balranald Project due to its inland setting.

Input data types required for the AERMOD model include: meteorological data (from AERMET), source data (from the compiled emissions inventory), source and receptor elevations and information on the nature of the receptor grid.

Meteorological Model Input into AERMOD

The AERMOD system is composed of two pre-processors that generate the input files required by the AERMOD dispersion model: AERMET (for the preparation of meteorological data) and AERMAP (for the preparation of terrain data). Terrain data for the modelling domain was sourced from NASA's Shuttle Radar Topography Mission (SRTM) data. This data set provided a high-resolution topography at 3 arc-second (~90m) grid spacing. Further discussion on topography of the Balranald Project site are provided within **Section** 3.

In applying the AERMET meteorological processor to prepare the meteorological data for the AERMOD model, appropriate values for three surface characteristics need to be determined: surface roughness length, albedo, and Bowen ratio. Surface roughness length is related to the height of obstacles in the path of wind flow and is, in principle, the height at which the mean horizontal wind speed is zero based on a logarithmic profile. The surface roughness length influences the surface shear stress and is an important factor in determining the magnitude of mechanical turbulence and the stability of the boundary layer. The albedo is the fraction of total incident solar radiation reflected by the surface back to space without absorption. The daytime Bowen ratio, an indicator of surface moisture, is the ratio of sensible heat flux to latent heat flux and is used for determining planetary boundary layer parameters for convective conditions driven by the surface sensible heat flux.

The Balranald Project is situated within a semi-arid landscape, with reference was made to Sturman, and Tapper (2006) in assigning surface roughness, Bowen ratio and albedo values suitable for this land cover category.

Whereas terrain and land use information was available for the project area, no site-specific hourly meteorological monitoring data was available for input within AERMET. Meteorological modelling data (CALMET Hybrid model data) for the 2011 calendar year was verified and applied within the AERMET model, with the AERMET model providing the inputs required for the AERMOD dispersion model.

Source and Emissions

Emissions estimated for the Balranald Project, as documented in **Section** 7 and **Appendix D**, were simulated using a range of sources types. Hourly varying TSP, PM_{10} and $PM_{2.5}$ emission data generated from the emissions inventory were input in the dispersion modelling to facilitate the prediction of dust deposition rates (in the case of TSP emissions) and suspended PM_{10} and $PM_{2.5}$ concentrations.

Mine pit dimensions for each modelling year were incorporated into the regional terrain data and input into the model to account for variations in source and receptor elevations (AHD).

Appendix C

Seasonal and Diurnal Wind Rose for the Balranald Project site

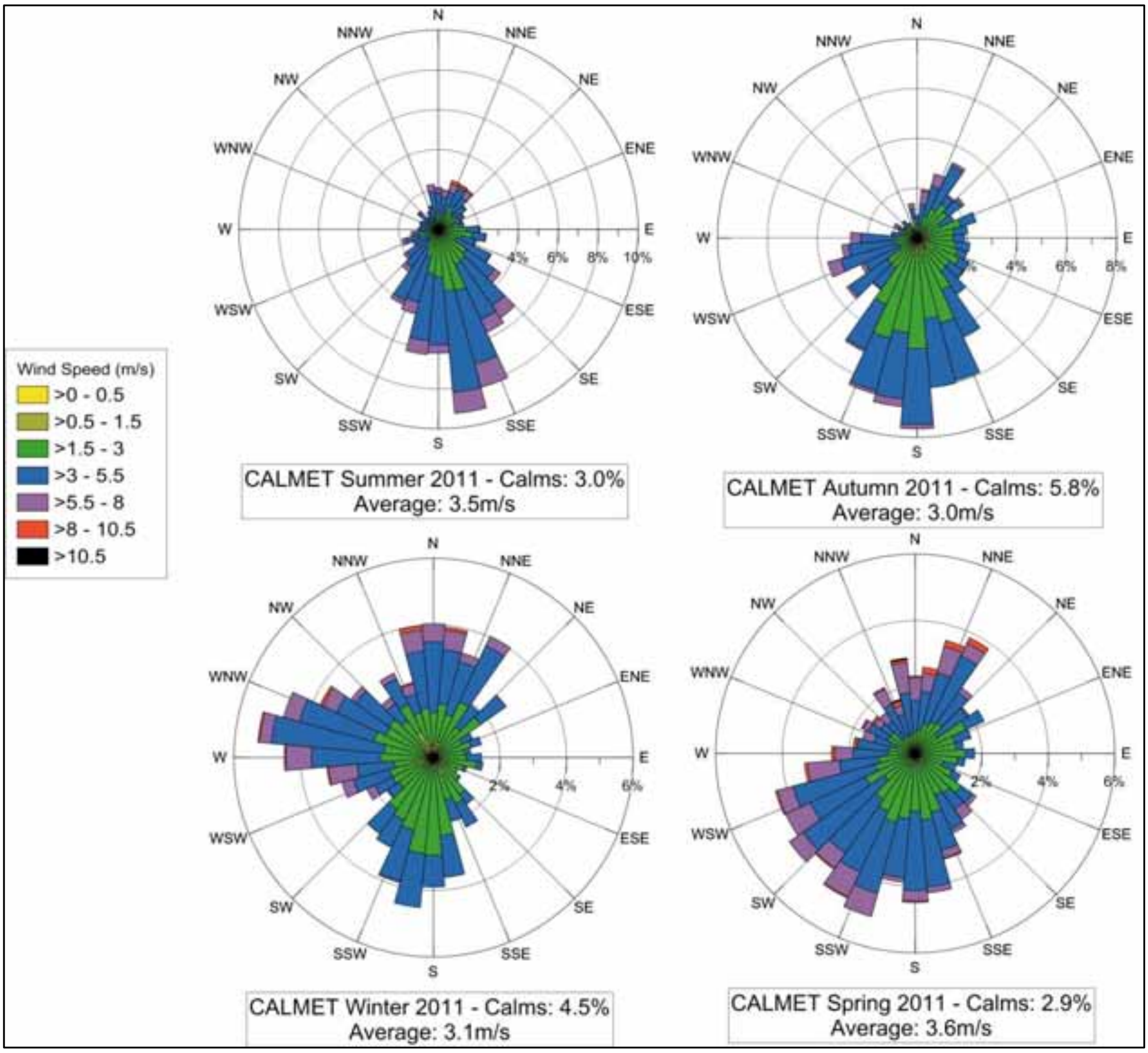

Figure C1. Seasonal wind roses – Balranald Project

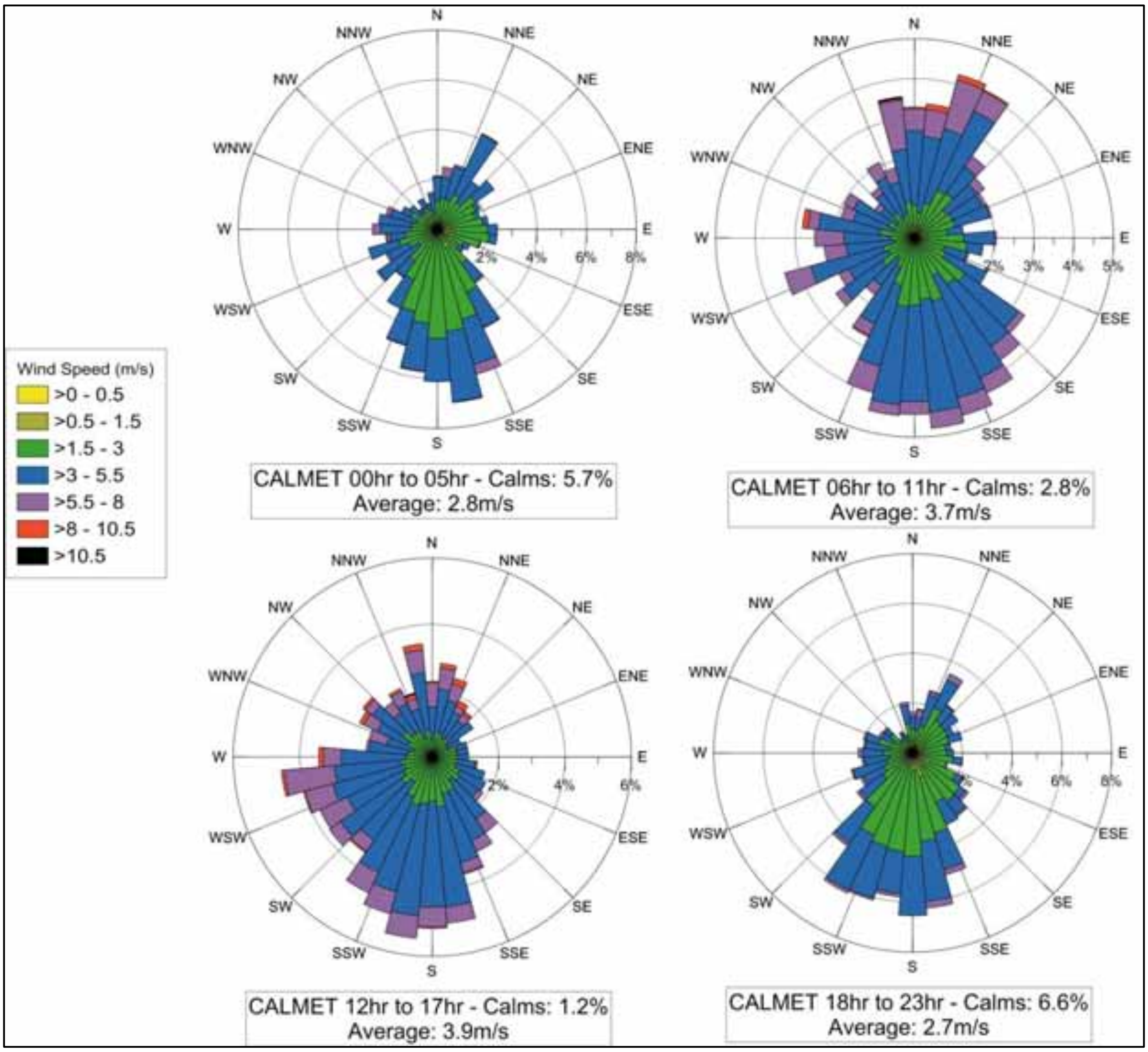

Figure C2. Diurnal wind roses – Balranald Project

Appendix D

Emissions Inventory

Air emissions from the Balranald Project were estimated using the following:

- United States Environmental Protection Authority (USEPA) AP-42 Emission Factors.
- National Pollution Inventory Emissions Estimation Technique Manual for Mining and Processing of Non-Metallic Minerals.
- National Pollution Inventory Emissions Estimation Technique Manual For Mineral Sands Mining and Processing.

Particulate emissions were quantified for three different size fractions: particulates with an aerodynamic diameter less than 30µm (TSP); particulates with an aerodynamic diameter less than 10µm (PM_{10}); and particulates with an aerodynamic diameter less than 2.5 µm ($PM_{2.5}$). Emission factor equations were primarily used to estimate TSP emissions while the finer fractions (PM_{10} and $PM_{2.5}$) were quantified based on ratios for the different particle size fractions available within the literature (principally the USEPA AP-42).

Mine activities associated with particulate matter emissions were identified as the following:

- Wheel generated emissions from vehicle movements on unpaved roads;
- Loading and dumping of overburden, topsoil and subsoil material;
- Loading and dumping of Run-of-Mine (ROM) ore;
- ROM pad dumping direct and re-handle by front end loader (FEL) to hopper;
- Loading and dumping of ISP tailings;
- Bulldozer operations on overburden, topsoil and subsoil;
- Ore screening;
- Wind erosion of active mining areas;
- Wind erosion of cleared areas;
- Wind erosion of overburden emplacement areas
- Wind erosion of topsoil stockpile areas;
- Wind erosion of tailings storage dam;
- Scrapers on topsoil and subsoil
- Road maintenance by grader; and
- Exhaust from baghouse stack.

Emission factors applied

Unpaved roads

The emissions factor for unpaved roads is taken from *USEPA AP42 Chapter 13.2.2 Unpaved Roads* (November 2006) as follows:

$$E = k\,(s/12)^{a}\,(W/3)^{b}$$

Where,

E = Emissions Factor (lb/VMT, i.e. pounds per vehicle miles travelled)

s = surface material silt content (%)

W = mean vehicle weight (Short Tonnes US)

The following constants are applicable:

Constant	TSP (assumed from PM_{30})	PM_{10}	$PM_{2.5}$
K (lb/VMT)	4.9	1.5	0.15
A	0.7	0.9	0.9
B	0.45	0.45	0.45

The metric conversion from lb/VMT to g/VKT (grams per vehicle kilometre travelled) is as follows:

1 lb/VMT = 0.2819 kg/VKT

The surface material silt content and mean vehicle weight information is site-specific as documented in the following section.

Scrapers and tractor scoops on topsoil

The emissions factors for topsoil scraping activities are taken from *USEPA AP42 Chapter 11.9 Western Surface Coal Mining (October 1998)* as documented in the table below. No PM_{10} and $PM_{2.5}$ factors defined for this activity and therefore scaling factors for PM_{10} and $PM_{2.5}$ emissions from Grading are applied. The emission factors are expressed in kilograms of emissions per tonne of material (topsoil) stripped.

Activity	TSP	PM_{10}	$PM_{2.5}$	Units
Topsoil stripping	0.029	TSP x 0.6	TSP x 0.031	kg/tonne
Scraper unloading (batch drop)	0.02	TSP x 0.6	TSP x 0.031	kg/tonne

Bulldozing

The emissions factors for bulldozing activities are taken from *USEPA AP42 Chapter 11.9 Western Surface Coal Mining* (October 1998). The emission factor applicable for overburden is documented in the table below. The emission factors are expressed in kilogram of emissions per hour of dozer activity.

Material	TSP	PM_{10}	$PM_{2.5}$	Units
Topsoil/ Subsoil/ Overburden	$\frac{2.6(s)^{1.2}}{(M)^{1.3}}$	$\frac{0.45(s)^{1.5}}{(M)^{1.4}} \times 0.75$	$\frac{2.6(s)^{1.2}}{(M)^{1.3}} \times 0.105$	kg/hr

Where,

s = material silt content (%)

M = material moisture content (%)

Grading

Emissions factors for grading are taken from *USEPA AP42 Chapter 11.9 Western Surface Coal Mining* (October 1998) as documented in the table below. The emission factors are expressed in kilogram of emissions per vehicle kilometre travelled (VKT).

TSP	**PM_{10}**	**$PM_{2.5}$**	**Units**
$0.0034 (S)^{2.5}$	$0.0056 (S)^{2.0} \times 0.6$	TSP x 0.031	kg/VKT

Where,

VKT= Vehicles Kilometres Travelled

S = mean vehicle speed (km/h)

Material Handling

Reference was made to the materials handling equation *from USEPA AP42 Chapter 13.2.4 "Aggregate Handling and Storage Piles (November 2006)* for the quantification of emissions from the following batch and continuous drop operations:

- Trucks loading and unloading.
- Stacking to stockpiles.

The equation is expressed as follows:

$$E = k\,0.0016\left(\frac{U}{2.2}\right)^{1.3}\left(\frac{M}{2}\right)^{-1.4}$$

Where,

E = Emissions factor (kg/Mg)

k = 0.74 for particles less than 30 µm

k = 0.35 for particles less than 10 µm

k = 0.053 for particles less than 2.5 µm

U = mean wind speed (m/s)

M = material moisture content (%).

The mean wind speed and material moisture content are documented in the subsequent section.

Screening

Emissions factors for controlled screening are taken from *USEPA AP42 Chapter 11.19.2 "Crushed Stone Processing and Pulverized Mineral Processing.* The emission factors are expressed in kilogram of emissions per tonne of material screened.

TSP	**PM_{10}**	**$PM_{2.5}$**	**Units**
0.0011	0.00037	TSP x 0.000025	kg/t

Wind Erosion of exposed surfaces

The emissions factor for wind erosion from exposed surfaces (cleared areas, open pit, stockpiles) are taken from *USEPA AP42 Chapter 11.9 Western Surface Coal Mining (October 1998)* as documented in the table below. No PM_{10} and $PM_{2.5}$ factors defined for this activity and therefore scaling factors for PM_{10} and $PM_{2.5}$ emissions from Chapter 13.2.5 Industrial Wind Erosion are applied

Activity	**TSP**	**PM_{10}**	**$PM_{2.5}$**	**Units**
Wind erosion of exposed ground	0.1	TSP x 0.5	TSP x 0.075	kg/ha/hr

Site Specific Input

A summary of the site-specific information input into the emission estimation calculations is provided in the table below. Material property data has been based primarily on site-specific information. When site-specific data is not available/ not relevant for the purpose (eg silt content analysis where material is pulverized), material property has been obtained from either Iluka's WRP mineral sand operations or NPI/AP42 default values.

Description	Units	Value	Source of Information
Site Variables			
Moisture Content of topsoil and subsoil	%	3.2	Information provided by Iluka
Moisture Content of NSOB	%	8.5	Information provided by Iluka
Moisture Content of SOB	%	8.5	Information provided by Iluka
Moisture Content of PAF	%	15.9	Information provided by Iluka
Moisture Content of ROM Ore	%	7.7	Information provided by Iluka
Moisture Content of HMC	%	7.7	Assumed equal to ROM Ore
Moisture Content of ilmenite	%	7.7	Assumed equal to ROM Ore
Moisture Content of tailing	%	2.0	Tailings are dry when handled. Hence assumed lower moisture content.
Silt Content of unpaved road surface	%	7.9	Assumed equal to topsoil and subsoil
Silt Content of topsoil	%	7.9	Based on average of all soil samples taken at site
Silt Content of subsoil	%	7.9	Based on average of all samples taken at site
Silt Content of NSOB	%	25.0	Based on sampling undertaken at Iluka's WRP mine.
Silt Content of SOB	%	25.0	Based on sampling undertaken at Iluka's WRP mine.
Silt Content of PAF	%	25.0	Based on sampling undertaken at Iluka's WRP mine.
Silt Content of tailings	%	100.0	Information provided by Iluka
Meteorological Data			

Description	Units	Value	Source of Information
Mean Wind Speed	m/s	3.3	Calculated based on 2011 CALMET generated met (**Section 5.3**)
No of Rain Days (>0.25mm)	days	58.0	Calculated based on 2011 rainfall levels recorded at BOM station at Mildura Airport.
Wind Speed > 5.4m/s	%	10.0	Calculated based on 2011 CALMET generated met (**Section 5.3**)
Wheel Generated Dust - Vehicles			
Grader Speed	km/h	8.0	Based on Iluka's WRP mine data
Weight of Haul Trucks - in-site transfer	Tonnes	249	Average of the loaded and unloaded weight (to account for a return trip) of all trucks used on site
Weight of Haul Trucks - ex-site transfer	Tonnes	51.0	Information provided by Iluka
Weight of Scraper	Tonnes	92.0	Based on machine specifications

Emission Inventories

YEAR 1 - PM10

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Soil stripping and re-handling																
Dozer clearing vegetation	596	415	h/y	1.4	kg/h	3.2	moisture coı	7.9	silt content in %							
Scraper stripping soil	16,819	966,600	t/yr	0.02	kg/t											
Scraper unload	11,599	966,600	t/yr	0.01	kg/t											
Soil Re-handle (excavator to truck)	341	702,396	t/yr	0.0005	kg/t	3.2	moisture coı	1.7	(wind speed/2.2)^1.3							
Soil Re-handle (haul to pit)	3,095	702,396	t/yr	0.03	kg/t	203	t/load	249	Vehicle gros	2.7	km/return tri	2.20	kg/VKT	7.9	% silt conter	85
Soil Re-handle (truck unload)	341	702,396	t/yr	0.0005	kg/t	3.2	moisture coı	1.7	(wind speed/2.2)^1.3							
Dozer soil spreading	433	301	h/y	1.4	kg/h	3.2	moisture coı	7.9	silt content in %							
Overburden																
Dozer on NSOB in pit	11,081	5,233	h/y	2.1	kg/h	8.5	moisture coı	25.0	silt content in %							
NSOB - Ex loading trucks	1,717	19,517,786	t/y	0.0001	kg/t	8.5	moisture coı	1.7	(wind speed/2.2)^1.3							30
NSOB - Haul to direct placement	5,373	2,993,386	t/y	0.01	kg/t	203	t/load	249	Vehicle gros	1.1	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
NSOB - unload to direct placement	376	2,993,386	t/y	0.0001	kg/t	8.5	moisture coı	1.7	(wind speed/2.2)^1.3							
NSOB - Haul to stockpile	29,661	16,524,400	t/y	0.01	kg/t	203	t/load	249	Vehicle gros	1.1	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
NSOB - unload to stockpile	2,076	16,524,400	t/y	0.0001	kg/t	8.5	moisture coı	1.7	(wind speed/2.2)^1.3							
NSOB - rehandle - Ex loading trucks	0	0	t/y	0.0001	kg/t	8.5	moisture coı	1.7	(wind speed/2.2)^1.3							30
NSOB - rehandle - Haul to pit	0	0	t/y	0.01	kg/t	203	t/load	249	Vehicle gros	1.1	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
NSOB - rehandle - unload to pit	0	0	t/y	0.0001	kg/t	8.5	moisture coı	1.7	(wind speed/2.2)^1.3							
Dozer on SOB	26,013	12,286	h/y	2.1	kg/h	8.5	moisture coı	25.0	silt content in %							
SOB - Ex loading trucks	2,999	34,102,688	t/y	0.0001	kg/t	8.5	moisture coı	1.7	(wind speed/2.2)^1.3							30
SOB - Haul to direct placement	95,772	24,454,500	t/y	0.03	kg/t	203	t/load	249	Vehicle gros	2.4	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
SOB - Truck unload to direct placement	3,073	24,454,500	t/y	0.0001	kg/t	8.5	moisture coı	1.7	(wind speed/2.2)^1.3							
SOB - Haul to stockpile	151,142	9,648,188	t/y	0.10	kg/t	203	t/load	249	Vehicle gros	9.6	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
SOB - Unload to stockpile	1,212	9,648,188	t/y	0.0001	kg/t	8.5	moisture coı	1.7	(wind speed/2.2)^1.3							
SOB - rehandle - Ex loading trucks	271	3,082,421	t/y	0.0001	kg/t	8.5	moisture coı	1.7	(wind speed/2.2)^1.3							30
SOB - rehandle - Haul to pit	48,287	3,082,421	t/y	0.10	kg/t	203	t/load	249	Vehicle gros	9.6	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
SOB - rehandle - unload to pit	387	3,082,421	t/y	0.0001	kg/t	8.5	moisture coı	1.7	(wind speed/2.2)^1.3							

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Dozer on PAF	1,045	1,195	h/y	0.9	kg/h	15.9	moisture co	25.0	silt content in %							
PAF - Ex loading trucks	83.4	2,294,188	t/y	0.0001	kg/t	15.9	moisture co	1.7	(wind speed/2.2)^1.3							30
PAF - haul to direct placement	2,363	2,068,950	t/y	0.01	kg/t	203	t/load	249	Vehicle gros	0.7	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
PAF - Truck unload to direct placement	107	2,068,950	t/y	0.0001	kg/t	15.9	moisture co	1.7	(wind speed/2.2)^1.3							
PAF - haul to stockpile	257	225,239	t/y	0.01	kg/t	203	t/load	249	Vehicle gros	0.7	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
PAF - Unload to stockpile	12	225,239	t/y	0.0001	kg/t	15.9	moisture co	1.7	(wind speed/2.2)^1.3							
PAF - rehandle - Ex loading trucks	12	231,996	t/y	0.0001	kg/t	15.9	moisture co	1.7	(wind speed/2.2)^1.3							
PAF - rehandle - Haul to pit	265	231,996	t/y	0.01	kg/t	203	t/load	249	Vehicle gros	0.7	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
PAF - rehandle - unload to pit	12	231,996	t/y	0.0001	kg/t	15.9	moisture co	1.7	(wind speed/2.2)^1.3							
Ore																
Excavator loading truck	281.9	2,802,487	t/y	0.0001	kg/t	7.7	moisture co	1.7	(wind speed/2.2)^1.3							30
Haul to MUP	7,317.0	2,802,487	t/y	0.02	kg/t	203	t/load	249	Vehicle gros	1.6	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
Unload at MUP	402.7	2,802,487	t/y	0.0001	kg/t	7.7	moisture co	1.7	(wind speed/2.2)^1.3							
FEL/Dozer at MUP	3,491	3,845	h/y	0.9	kg/h	7.7	moisture co	13.0	silt content in %							
Ore Screening at MUP	1,037	2,802,487	t/y	0.0004	kg/t											
Product and Waste																
HMC - loading stockpiles	71.9	500,000	t/y	0.0001	kg/t	7.7	moisture co	1.7	(wind speed/2.2)^1.3							
HMC - loading trucks	71.9	500,000	t/y	0.0001	kg/t	7.7	moisture co	1.7	(wind speed/2.2)^1.3							
HMC - haul off-site	14,026	500,000	t/y	0.31	kg/t	45	t/load	51	Vehicle gros	13.0	km/return tri	1.1	kg/VKT	7.9	% silt conter	91
WHIMS Product Drying (Baghouse Stack)	27,909	18	m3/s	50	mg/m3											
WHIMS Product Screening	241	650,000	t/y	0.0004	kg/t											
Illmenite - loading trucks	93.4	650,000	t/y	0.0001	kg/t	7.7	moisture co	1.7	(wind speed/2.2)^1.3							
Illmenite - haul off-site	18,234	650,000	t/y	0.31	kg/t	45	t/load	51	Vehicle gros	13.0	km/return tri	1.1	kg/VKT	7.9	% silt conter	91
Tailings - loading trucks	1,250.8	1,318,494	t/y	0.0009	kg/t	2.0	moisture co	1.7	(wind speed/2.2)^1.3							
Tailings - haulage to pit	22,323.6	1,318,494	t/y	0.11	kg/t	203	t/load	244	Vehicle gros	10.5	km/return tri	2.2	kg/VKT	7.9	% silt conter	85

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Tailings - unload to pit	1,250.8	1,318,494	t/y	0.0009	kg/t	2.0	moisture cor	1.7	(wind speed/2.2)^1.3							
Wind Erosion																
Active Pit	25,500	60	ha	0.05	kg/ha/h	8,760	h/y									
NSOB Stockpile	14,875	35	ha	0.05	kg/ha/h	8,760	h/y									0
SOB Stockpile	29,750	70	ha	0.05	kg/ha/h	8,760	h/y									0
Soil Stockpile	8,500	20	ha	0.05	kg/ha/h	8,760	h/y									0
MUP Stockpile	1,913	4.5	ha	0.05	kg/ha/h	8,760	h/y									
Product stockpiles	230	0.5	ha	0.05	kg/ha/h	8,760	h/y									
Exposed tailings	4,006	9.4	ha	0.05	kg/ha/h	8,760	h/y									
Miscellaneous																
Grader	15,388	71,560	km	0.2	kg/km	8	speed of gra	8,945	grader hours							
Total (kg/yr)	**614,984**															

YEAR 1 - PM2.5

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Soil stripping and re-handling																
Dozer clearing vegetation	292	415	h/y	0.7	kg/h	3.2	moisture cor	7.9	silt content in %							
Scraper stripping soil	869	966,600	t/yr	0.001	kg/t											
Scraper unload	599	966,600	t/yr	0.001	kg/t											
Soil Re-handle (excavator to truck)	52	702,396	t/yr	0.0001	kg/t	3.2	moisture cor	1.7	(wind speed/2.2)^1.3							
Soil Re-handle (haul to pit)	309	702,396	t/yr	0.0029	kg/t	203	t/load	249	Vehicle gros	2.7	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
Soil Re-handle (truck unload)	52	702,396	t/yr	0.0001	kg/t	3.2	moisture cor	1.7	(wind speed/2.2)^1.3							
Dozer soil spreading	212	301	h/y	0.7	kg/h	3.2	moisture cor	7.9	silt content in %							
Overburden																
Dozer on NSOB in pit	4,226	5,233	h/y	0.8	kg/h	8.5	moisture cor	25.0	silt content in %							
NSOB - Ex loading trucks	260	19,517,786	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
NSOB - Haul to direct placement	537	2,993,386	t/y	0.0012	kg/t	203	t/load	249	Vehicle gros	1.1	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
NSOB - unload to direct placement	57	2,993,386	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
NSOB - Haul to stockpile	2,966	16,524,400	t/y	0.0012	kg/t	203	t/load	249	Vehicle gros	1.1	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
NSOB - unload to stockpile	314	16,524,400	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
NSOB - rehandle - Ex loading trucks	0	0	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
NSOB - rehandle - Haul to pit	0	0	t/y	0.0012	kg/t	203	t/load	249	Vehicle gros	1.1	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
NSOB - rehandle - unload to pit	0	0	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
Dozer on SOB	9,920	12,286	h/y	0.8	kg/h	8.5	moisture cor	25.0	silt content in %							
SOB - Ex loading trucks	454	34,102,688	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
SOB - Haul to direct placement	9,577	24,454,500	t/y	0.0026	kg/t	203	t/load	249	Vehicle gros	2.4	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
SOB - Truck unload to direct placement	465	24,454,500	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
SOB - Haul to stockpile	15,114	9,648,188	t/y	0.0104	kg/t	203	t/load	249	Vehicle gros	9.6	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
SOB - Unload to stockpile	184	9,648,188	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
SOB - rehandle - Ex loading trucks	41	3,082,421	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
SOB - rehandle - Haul to pit	4,829	3,082,421	t/y	0.0104	kg/t	203	t/load	249	Vehicle gros	9.6	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
SOB - rehandle - unload to pit	59	3,082,421	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Dozer on PAF	425	1,195	h/y	0.4	kg/h	15.9	moisture cor	25.0	silt content in %							
PAF - Ex loading trucks	12.6	2,294,188	t/y	0.00001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							30
PAF - haul to direct placement	236	2,068,950	t/y	0.0008	kg/t	203	t/load	249	Vehicle gros	0.7	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
PAF - Truck unload to direct placement	16	2,068,950	t/y	0.00001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
PAF - haul to stockpile	26	225,239	t/y	0.0008	kg/t	203	t/load	249	Vehicle gros	0.7	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
PAF - Unload to stockpile	28	225,239	t/y	0.00001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
PAF - rehandle - Ex loading trucks	2	231,996	t/y	0.00001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
PAF - rehandle - Haul to pit	27	231,996	t/y	0.0008	kg/t	203	t/load	249	Vehicle gros	0.7	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
SOB - rehandle - unload to pit	2	231,996	t/y	0.00001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
Ore																
Excavator loading truck	42.7	2,802,487	t/y	0.00002	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							30
Haul to MUP	731.7	2,802,487	t/y	0.0017	kg/t	203	t/load	249	Vehicle gros	1.6	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
Unload at MUP	61.0	2,802,487	t/y	0.00002	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
FEL/Dozer at MUP	1,605	3,845	h/y	0.4	kg/h	7.7	moisture cor	13.0	silt content in %							
Ore Screening at MUP	70	2,802,487	t/y	0.00003	kg/t											
Product and Waste																
HMC - loading stockpiles	10.9	500,000	t/y	0.00002	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
HMC - loading trucks	10.9	500,000	t/y	0.00002	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
HMC - haul off-site	1,403	500,000	t/y	0.0312	kg/t	45	t/load	51	Vehicle gros	13.0	km/return tri	0.1	kg/VKT	7.9	% silt conter	91
WHIMS Product Drying (Baghouse Stack)	27,909	18	m3/s	50.00	mg/m3											
WHIMS Product Screening	16	650,000	t/y	0.00003	kg/t											
Illmenite - loading trucks	14.1	650,000	t/y	0.00002	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
Illmenite - haul off-site	1,823	650,000	t/y	0.0312	kg/t	45	t/load	51	Vehicle gros	13.0	km/return tri	0.1	kg/VKT	7.9	% silt conter	91
Tailings - loading trucks	189.4	1,318,494	t/y	0.00014	kg/t	2.0	moisture cor	1.7	(wind speed/2.2)^1.3							
Tailings - haulage to pit	2,232.4	1,318,494	t/y	0.0113	kg/t	203	t/load	244	Vehicle gros	10.5	km/return tri	0.2	kg/VKT	7.9	% silt conter	85

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Tailings - unload to pit	189.4	1,318,494	t/y	0.00014	kg/t	2.0	moisture cor	1.7	(wind speed/2.2)^1.3							
Wind Erosion																
Active Pit	3,825	60	ha	0.01	kg/ha/h	8,760	h/y									0
NSOB Stockpile	2,231	35	ha	0.01	kg/ha/h	8,760	h/y									0
SOB Stockpile	4,463	70	ha	0.01	kg/ha/h	8,760	h/y									0
Soil Stockpile	1,275	20	ha	0.01	kg/ha/h	8,760	h/y									0
MUP Stockpile	287	4.5	ha	0.01	kg/ha/h	8,760	h/y									0
Product stockpiles	34	0.54	ha	0.01	kg/ha/h	8,760	h/y									0
Exposed tailings	601	9.4	ha	0.01	kg/ha/h	8,760	h/y									0
Miscellaneous																
Grader	15,388	71,560	km	0.2	kg/km	8	speed of gra	8,945	grader hours							
Total PM10 (kg/yr)	**116,575**															

YEAR 1 - TSP

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Soil stripping and re-handling																
Dozer clearing vegetation	2,783	415	h/y	6.7	kg/h	3.2	moisture co	7.9	silt content in %							
Scraper stripping soil	28,031	966,600	t/yr	0.03	kg/t											
Scraper unload	19,332	966,600	t/yr	0.02	kg/t											
Soil Re-handle (excavator to truck)	720	702,396	t/yr	0.001	kg/t	3.2	moisture co	1.7	(wind speed/2.2)^1.3							
Soil Re-handle (haul to pit)	11,005	702,396	t/yr	0.10	kg/t	203	t/load	249	Vehicle gros	2.7	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
Soil Re-handle (truck unload)	720	702,396	t/yr	0.001	kg/t	3.2	moisture co	1.7	(wind speed/2.2)^1.3							
Dozer soil spreading	2,022	301	h/y	6.7	kg/h	3.2	moisture co	7.9	silt content in %							
Overburden																
Dozer on NSOB in pit	40,245	5,233	h/y	7.7	kg/h	8.5	moisture co	25.0	silt content in %							0
NSOB - Ex loading trucks	3,629	19,517,786	t/y	0.0003	kg/t	8.5	moisture co	1.7	(wind speed/2.2)^1.3							30
NSOB - Haul to direct placement	19,107	2,993,386	t/y	0.04	kg/t	203	t/load	249	Vehicle gros	1.1	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
NSOB - unload to direct placement	795	2,993,386	t/y	0.0003	kg/t	8.5	moisture co	1.7	(wind speed/2.2)^1.3							
NSOB - Haul to stockpile	105,476	16,524,400	t/y	0.04	kg/t	203	t/load	249	Vehicle gros	1.1	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
NSOB - unload to stockpile	4,390	16,524,400	t/y	0.0003	kg/t	8.5	moisture co	1.7	(wind speed/2.2)^1.3							0
NSOB - rehandle - Ex loading trucks	0	0	t/y	0.0003	kg/t	8.5	moisture co	1.7	(wind speed/2.2)^1.3							30
NSOB - rehandle - Haul to pit	0	0	t/y	0.04	kg/t	203	t/load	249	Vehicle gros	1.1	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
NSOB - rehandle - unload to pit	0	0	t/y	0.0003	kg/t	8.5	moisture co	1.7	(wind speed/2.2)^1.3							0
Dozer on SOB	94,475	12,286	h/y	7.7	kg/h	8.5	moisture co	25.0	silt content in %							0
SOB - Ex loading trucks	6,342	34,102,688	t/y	0.0003	kg/t	8.5	moisture co	1.7	(wind speed/2.2)^1.3							30
SOB - Haul to direct placement	340,569	24,454,500	t/y	0.09	kg/t	203	t/load	249	Vehicle gros	2.4	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
SOB - Truck unload to direct placement	6,496	24,454,500	t/y	0.0003	kg/t	8.5	moisture co	1.7	(wind speed/2.2)^1.3							0
SOB - Haul to stockpile	537,468	9,648,188	t/y	0.37	kg/t	203	t/load	249	Vehicle gros	9.6	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
SOB - Unload to stockpile	2,563	9,648,188	t/y	0.0003	kg/t	8.5	moisture co	1.7	(wind speed/2.2)^1.3							0
SOB - rehandle - Ex loading trucks	573	3,082,421	t/y	0.0003	kg/t	8.5	moisture co	1.7	(wind speed/2.2)^1.3							30
SOB - rehandle - Haul to pit	171,711	3,082,421	t/y	0.37	kg/t	203	t/load	249	Vehicle gros	9.6	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
SOB - rehandle - unload to pit	819	3,082,421	t/y	0.0003	kg/t	8.5	moisture co	1.7	(wind speed/2.2)^1.3							0

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Dozer on PAF	4,044	1,195	h/y	3.4	kg/h	15.9	moisture cor	25.0	silt content in %							0
PAF - Ex loading trucks	176.3	2,294,188	t/y	0.0001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							30
PAF - haul to direct placement	8,404	2,068,950	t/y	0.03	kg/t	203	t/load	249	Vehicle gros	0.7	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
PAF - Truck unload to direct placement	227	2,068,950	t/y	0.0001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
PAF - haul to stockpile	915	225,239	t/y	0.03	kg/t	203	t/load	249	Vehicle gros	0.7	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
PAF - Unload to stockpile	25	225,239	t/y	0.0001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
PAF - rehandle - Ex loading trucks	25	231,996	t/y	0.0001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
PAF - rehandle - Haul to pit	942	231,996	t/y	0.03	kg/t	203	t/load	249	Vehicle gros	0.7	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
PAF - rehandle - unload to pit	25	231,996	t/y	0.0001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
Ore																
Excavator loading truck	596.0	2,802,487	t/y	0.0003	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							30
Haul to MUP	26,019.5	2,802,487	t/y	0.06	kg/t	203	t/load	249	Vehicle gros	1.6	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
Unload at MUP	851.5	2,802,487	t/y	0.0003	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
FEL/Dozer at MUP	15,281	3,845	h/y	4.0	kg/h	7.7	moisture cor	13.0	silt content in %							
Ore Screening at MUP	3,083	2,802,487	t/y	0.0011	kg/t	0.0	0	0.0	0							
Product and Waste																
HMC - loading stockpiles	151.9	500,000	t/y	0.0003	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
HMC - loading trucks	151.9	500,000	t/y	0.0003	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
HMC - haul off-site	49,876	500,000	t/y	1.11	kg/t	45	t/load	51	Vehicle gros	13.0	km/return tri	3.8	kg/VKT	7.9	% silt conter	91
WHIMS Product Drying (Baghouse Stack)	27,909	18	m3/s	50.00	mg/m3											
WHIMS Product Screening	715	650,000	t/y	0.0011	kg/t											
Illmenite - loading trucks	197.5	650,000	t/y	0.0003	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
Illmenite - haul off-site	64,839	650,000	t/y	1.11	kg/t	45	t/load	51	Vehicle gros	13.0	km/return tri	3.8	kg/VKT	7.9	% silt conter	91
Tailings - loading trucks	2,644.5	1,318,494	t/y	0.0020	kg/t	2.0	moisture cor	1.7	(wind speed/2.2)^1.3							

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Tailings - haulage to pit	79,383.9	1,318,494	t/y	0.40	kg/t	203	t/load	244	Vehicle gros	10.5	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
Tailings - unload to pit	2,644.5	1,318,494	t/y	0.0020	kg/t	2.0	moisture cor	1.7	(wind speed/2.2)^1.3							
Wind Erosion																
Active Pit	51,000	60	ha	0.1	kg/ha/h	8,760	h/y									0
NSOB Stockpile	29,750	35	ha	0.1	kg/ha/h	8,760	h/y									0
SOB Stockpile	59,500	70	ha	0.1	kg/ha/h	8,760	h/y									0
Soil Stockpile	17,000	20	ha	0.1	kg/ha/h	8,760	h/y									0
MUP Stockpile	3,825	4.5	ha	0.1	kg/ha/h	8,760	h/y									0
Product stockpiles	459	0.54	ha	0.1	kg/ha/h	8,760	h/y									0
Exposed tailings	8,011	9.4	ha	0.1	kg/ha/h	8,760	h/y									0
Miscellaneous																
Grader	44,043	71,560	km	0.6	kg/km	8	speed of gra	8,945	grader hours							
Total (kg/yr)	**1,901,990**															

YEAR 4 - PM10

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Soil stripping and re-handling																
Dozer clearing vegetation	1,260	876	h/y	1.4	kg/h	3.2	moisture cor	7.9	silt content in %							
Scraper stripping soil	34,389	1,976,400	t/yr	0.02	kg/t											
Scraper unload	23,717	1,976,400	t/yr	0.01	kg/t											
Soil Re-handle (excavator to truck)	704	1,452,292	t/yr	0.0005	kg/t	3.2	moisture cor	1.7	(wind speed/2.2)^1.3							
Soil Re-handle (haul to pit)	8,058	1,452,292	t/yr	0.04	kg/t	203	t/load	249	Vehicle gros	3.4	km/return tri	2.20	kg/VKT	7.9	% silt conter	85
Soil Re-handle (truck unload)	704	1,452,292	t/yr	0.0005	kg/t	3.2	moisture cor	1.7	(wind speed/2.2)^1.3							
Dozer soil spreading	926	644	h/y	1.4	kg/h	3.2	moisture cor	7.9	silt content in %							
Overburden																
Dozer on NSOB in pit	14,526	6,860	h/y	2.1	kg/h	8.5	moisture cor	25.0	silt content in %							
NSOB - Ex loading trucks	1,361	15,471,903	t/y	0.0001	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
NSOB - Haul to direct placement	28,116	9,572,185	t/y	0.02	kg/t	203	t/load	249	Vehicle gros	1.8	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
NSOB - unload to direct placement	1,203	9,572,185	t/y	0.0001	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
NSOB - Haul to stockpile	17,329	5,899,718	t/y	0.02	kg/t	203	t/load	249	Vehicle gros	1.8	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
NSOB - unload to stockpile	741	5,899,718	t/y	0.0001	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
NSOB - rehandle - Ex loading trucks	0	0	t/y	0.0001	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
NSOB - rehandle - Haul to pit	0	0	t/y	0.02	kg/t	203	t/load	249	Vehicle gros	1.8	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
NSOB - rehandle - unload to pit	0	0	t/y	0.0001	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
Dozer on SOB	38,082	17,986	h/y	2.1	kg/h	8.5	moisture cor	25.0	silt content in %							
SOB - Ex loading trucks	3,568	40,562,579	t/y	0.0001	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
SOB - Haul to direct placement	185,333	40,562,579	t/y	0.03	kg/t	203	t/load	249	Vehicle gros	2.8	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
SOB - Truck unload to direct placement	5,097	40,562,579	t/y	0.0001	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
SOB - Haul to stockpile	0	0	t/y	0.13	kg/t	203	t/load	249	Vehicle gros	11.8	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
SOB - Unload to stockpile	0	0	t/y	0.0001	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
SOB - rehandle - Ex loading trucks	0	0	t/y	0.0001	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
SOB - rehandle - Haul to pit	0	0	t/y	0.13	kg/t	203	t/load	249	Vehicle gros	11.8	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
SOB - rehandle - unload to pit	0	0	t/y	0.0001	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Dozer on PAF	4,989	5,703	h/y	0.9	kg/h	15.9	moisture cor	25.0	silt content in %							
PAF - Ex loading trucks	428.0	11,777,947	t/y	0.0001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							30
PAF - haul to direct placement	16,336	11,777,947	t/y	0.01	kg/t	203	t/load	249	Vehicle gros	0.85	km/return trip	2.2	kg/VKT	7.9	% silt conter	85
PAF - Truck unload to direct placement	611	11,777,947	t/y	0.0001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
PAF - haul to stockpile	0	0	t/y	0.01	kg/t	203	t/load	249	Vehicle gros	0.85	km/return trip	2.2	kg/VKT	7.9	% silt conter	85
PAF - Unload to stockpile	0	0	t/y	0.0001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
PAF - rehandle - Ex loading trucks	0	0	t/y	0.0001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
PAF - rehandle - Haul to pit	0	0	t/y	0.01	kg/t	203	t/load	249	Vehicle gros	0.85	km/return trip	2.2	kg/VKT	7.9	% silt conter	85
PAF - rehandle - unload to pit	0	0	t/y	0.0001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
Ore																
Excavator loading truck	375.6	3,734,227	t/y	0.0001	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							30
Haul to MUP	29,248.9	3,734,227	t/y	0.05	kg/t	203	t/load	249	Vehicle gros	4.8	km/return trip	2.2	kg/VKT	7.9	% silt conter	85
Unload at MUP	536.6	3,734,227	t/y	0.0001	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
FEL/Dozer at MUP	6,256	6,890	h/y	0.9	kg/h	7.7	moisture cor	13.0	silt content in %							
Ore Screening at MUP	1,382	3,734,227	t/y	0.0004	kg/t											
Product and Waste																
HMC - loading stockpiles	71.9	500,000	t/y	0.0001	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
HMC - loading trucks	71.9	500,000	t/y	0.0001	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
HMC - haul off-site	14,026	500,000	t/y	0.31	kg/t	45	t/load	51	Vehicle gros	13.0	km/return trip	1.1	kg/VKT	7.9	% silt conter	91
WHIMS Product Drying (Baghouse Stack)	27,909	18	m3/s	50.00	mg/m3											
WHIMS Product Screening	241	650,000	t/y	0.0004	kg/t											
Illmenite - loading trucks	93.4	650,000	t/y	0.0001	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
Illmenite - haul off-site	18,234	650,000	t/y	0.31	kg/t	45	t/load	51	Vehicle gros	13.0	km/return trip	1.1	kg/VKT	7.9	% silt conter	91
Tailings - loading trucks	1,919.8	2,023,710	t/y	0.0009	kg/t	2.0	moisture cor	1.7	(wind speed/2.2)^1.3							
Tailings - haulage to pit	37,200.7	2,023,710	t/y	0.12	kg/t	203	t/load	244	Vehicle gros	11.4	km/return trip	2.2	kg/VKT	7.9	% silt conter	85

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Tailings - unload to pit	1,919.8	2,023,710	t/y	0.0009	kg/t	2.0	moisture cor	1.7	(wind speed/2.2)^1.3							
Wind Erosion																
Active Pit	25,500	60	ha	0.05	kg/ha/h	8,760	h/y									
NSOB Stockpile	19,550	46	ha	0.05	kg/ha/h	8,760	h/y									
SOB Stockpile	29,750	70	ha	0.05	kg/ha/h	8,760	h/y									
Soil Stockpile	17,000	40	ha	0.05	kg/ha/h	8,760	h/y									
MUP Stockpile	1,913	4.5	ha	0.05	kg/ha/h	8,760	h/y									
Product stockpiles	230	0.5	ha	0.05	kg/ha/h	8,760	h/y									
Exposed tailings	4,006	9.4	ha	0.05	kg/ha/h	8,760	h/y									
Miscellaneous																
Grader	33,366	155,160	km	0.2	kg/km	8	speed of gra	19,395	grader hours							
Total (kg/yr)	**658,276**															

YEAR 4 - PM2.5																
Source	**Emissions (kg/year)**	**Activity Intensity**	**Units**	**Emission Factor**	**Units**	**Equation Input Variables**										**Control %**
Soil stripping and re-handling																
Dozer clearing vegetation	618	876	h/y	0.7	kg/h	3.2	moisture cor	7.9	silt content in %							
Scraper stripping soil	1,777	1,976,400	t/yr	0.001	kg/t											
Scraper unload	1,225	1,976,400	t/yr	0.001	kg/t											
Soil Re-handle (excavator to truck)	107	1,452,292	t/yr	0.0001	kg/t	3.2	moisture cor	1.7	(wind speed/2.2)^1.3							
Soil Re-handle (haul to pit)	806	1,452,292	t/yr	0.0037	kg/t	203	t/load	249	Vehicle gros	3.4	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
Soil Re-handle (truck unload)	107	1,452,292	t/yr	0.0001	kg/t	3.2	moisture cor	1.7	(wind speed/2.2)^1.3							
Dozer soil spreading	454	644	h/y	0.7	kg/h	3.2	moisture cor	7.9	silt content in %							
Overburden																
Dozer on NSOB in pit	5,539	6,860	h/y	0.8	kg/h	8.5	moisture cor	25.0	silt content in %							
NSOB - Ex loading trucks	206	15,471,903	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
NSOB - Haul to direct placement	2,812	9,572,185	t/y	0.0020	kg/t	203	t/load	249	Vehicle gros	1.8	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
NSOB - unload to direct placement	182	9,572,185	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
NSOB - Haul to stockpile	1,733	5,899,718	t/y	0.0020	kg/t	203	t/load	249	Vehicle gros	1.8	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
NSOB - unload to stockpile	112	5,899,718	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
NSOB - rehandle - Ex loading trucks	0	0	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
NSOB - rehandle - Haul to pit	0	0	t/y	0.0020	kg/t	203	t/load	249	Vehicle gros	1.8	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
NSOB - rehandle - unload to pit	0	0	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
Dozer on SOB	14,522	17,986	h/y	0.8	kg/h	8.5	moisture cor	25.0	silt content in %							
SOB - Ex loading trucks	540	40,562,579	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
SOB - Haul to direct placement	18,533	40,562,579	t/y	0.0030	kg/t	203	t/load	249	Vehicle gros	2.8	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
SOB - Truck unload to direct placement	772	40,562,579	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
SOB - Haul to stockpile	0	0	t/y	0.0128	kg/t	203	t/load	249	Vehicle gros	11.8	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
SOB - Unload to stockpile	0	0	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
SOB - rehandle - Ex loading trucks	0	0	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
SOB - rehandle - Haul to pit	0	0	t/y	0.0128	kg/t	203	t/load	249	Vehicle gros	11.8	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
SOB - rehandle - unload to pit	0	0	t/y	0.00002	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Dozer on PAF	2,027	5,703	h/y	0.4	kg/h	15.9	moisture cor	25.0	silt content in %							
PAF - Ex loading trucks	64.8	11,777,947	t/y	0.00001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							30
PAF - haul to direct placement	1,634	11,777,947	t/y	0.0009	kg/t	203	t/load	249	Vehicle gros	0.85	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
PAF - Truck unload to direct placement	93	11,777,947	t/y	0.00001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
PAF - haul to stockpile	0	0	t/y	0.0009	kg/t	203	t/load	249	Vehicle gros	0.85	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
PAF - Unload to stockpile	0	0	t/y	0.00001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
PAF - rehandle - Ex loading trucks	0	0	t/y	0.00001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
PAF - rehandle - Haul to pit	0	0	t/y	0.0009	kg/t	203	t/load	249	Vehicle gros	0.85	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
SOB - rehandle - unload to pit	0	0	t/y	0.00001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
Ore																
Excavator loading truck	56.9	3,734,227	t/y	0.00002	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							30
Haul to MUP	2,924.9	3,734,227	t/y	0.0052	kg/t	203	t/load	249	Vehicle gros	4.8	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
Unload at MUP	81.3	3,734,227	t/y	0.00002	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
FEL/Dozer at MUP	2,875	6,890	h/y	0.4	kg/h	7.7	moisture cor	13.0	silt content in %							
Ore Screening at MUP	93	3,734,227	t/y	0.00003	kg/t											
Product and Waste																
HMC - loading stockpiles	10.9	500,000	t/y	0.00002	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
HMC - loading trucks	10.9	500,000	t/y	0.00002	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
HMC - haul off-site	1,403	500,000	t/y	0.0312	kg/t	45	t/load	51	Vehicle gros	13.0	km/return tri	0.1	kg/VKT	7.9	% silt conter	91
WHIMS Product Drying (Baghouse Stack)	27,909	18	m3/s	50.00	mg/m3											
WHIMS Product Screening	16	650,000	t/y	0.00003	kg/t											
Illmenite - loading trucks	14.1	650,000	t/y	0.00002	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
Illmenite - haul off-site	1,823	650,000	t/y	0.0312	kg/t	45	t/load	51	Vehicle gros	13.0	km/return tri	0.1	kg/VKT	7.9	% silt conter	91
Tailings - loading trucks	290.7	2,023,710	t/y	0.00014	kg/t	2.0	moisture cor	1.7	(wind speed/2.2)^1.3							
Tailings - haulage to pit	3,720.1	2,023,710	t/y	0.0123	kg/t	203	t/load	244	Vehicle gros	11.4	km/return tri	0.2	kg/VKT	7.9	% silt conter	85

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Tailings - unload to pit	290.7	2,023,710	t/y	0.00014	kg/t	2.0	moisture cor	1.7	(wind speed/2.2)^1.3							
Wind Erosion																
Active Pit	3,825	60	ha	0.01	kg/ha/h	8,760	h/y									0
NSOB Stockpile	2,933	46	ha	0.01	kg/ha/h	8,760	h/y									0
SOB Stockpile	4,463	70	ha	0.01	kg/ha/h	8,760	h/y									0
Soil Stockpile	2,550	40	ha	0.01	kg/ha/h	8,760	h/y									0
MUP Stockpile	287	5	ha	0.01	kg/ha/h	8,760	h/y									0
Product stockpiles	34	1	ha	0.01	kg/ha/h	8,760	h/y									0
Exposed tailings	601	9	ha	0.01	kg/ha/h	8,760	h/y									0
Miscellaneous																
Grader	33,366	155,160	km	0.2	kg/km	8	speed of gra	19,395	grader hours							
Total PM10 (kg/yr)	**143,440**															

YEAR 4 - TSP																
Source	**Emissions (kg/year)**	**Activity Intensity**	**Units**	**Emission Factor**	**Units**	**Equation Input Variables**										**Control %**
Soil stripping and re-handling																
Dozer clearing vegetation	5,883	876	h/y	6.7	kg/h	3.2	moisture cor	7.9	silt content in %							
Scraper stripping soil	57,316	1,976,400	t/yr	0.03	kg/t											
Scraper unload	39,528	1,976,400	t/yr	0.02	kg/t											
Soil Re-handle (excavator to truck)	1,489	1,452,292	t/yr	0.001	kg/t	3.2	moisture cor	1.7	(wind speed/2.2)^1.3							
Soil Re-handle (haul to pit)	28,653	1,452,292	t/yr	0.13	kg/t	203	t/load	249	Vehicle gros	3.4	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
Soil Re-handle (truck unload)	1,489	1,452,292	t/yr	0.001	kg/t	3.2	moisture cor	1.7	(wind speed/2.2)^1.3							
Dozer soil spreading	4,323	644	h/y	6.7	kg/h	3.2	moisture cor	7.9	silt content in %							
Overburden																
Dozer on NSOB in pit	52,755	6,860	h/y	7.7	kg/h	8.5	moisture cor	25.0	silt content in %							0
NSOB - Ex loading trucks	2,877	15,471,903	t/y	0.0003	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
NSOB - Haul to direct placement	99,981	9,572,185	t/y	0.07	kg/t	203	t/load	249	Vehicle gros	1.8	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
NSOB - unload to direct placement	2,543	9,572,185	t/y	0.0003	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
NSOB - Haul to stockpile	61,622	5,899,718	t/y	0.07	kg/t	203	t/load	249	Vehicle gros	1.8	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
NSOB - unload to stockpile	1,567	5,899,718	t/y	0.0003	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							0
NSOB - rehandle - Ex loading trucks	0	0	t/y	0.0003	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
NSOB - rehandle - Haul to pit	0	0	t/y	0.07	kg/t	203	t/load	249	Vehicle gros	1.8	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
NSOB - rehandle - unload to pit	0	0	t/y	0.0003	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							0
Dozer on SOB	138,308	17,986	h/y	7.7	kg/h	8.5	moisture cor	25.0	silt content in %							0
SOB - Ex loading trucks	7,543	40,562,579	t/y	0.0003	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
SOB - Haul to direct placement	659,051	40,562,579	t/y	0.11	kg/t	203	t/load	249	Vehicle gros	2.8	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
SOB - Truck unload to direct placement	10,776	40,562,579	t/y	0.0003	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							0
SOB - Haul to stockpile	0	0	t/y	0.46	kg/t	203	t/load	249	Vehicle gros	11.8	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
SOB - Unload to stockpile	0	0	t/y	0.0003	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							0
SOB - rehandle - Ex loading trucks	0	0	t/y	0.0003	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
SOB - rehandle - Haul to pit	0	0	t/y	0.46	kg/t	203	t/load	249	Vehicle gros	11.8	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
SOB - rehandle - unload to pit	0	0	t/y	0.0003	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							0

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Dozer on PAF	19,301	5,703	h/y	3.4	kg/h	15.9	moisture cor	25.0	silt content in %							0
PAF - Ex loading trucks	905.0	11,777,947	t/y	0.0001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							30
PAF - haul to direct placement	58,093	11,777,947	t/y	0.03	kg/t	203	t/load	249	Vehicle gros	0.85	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
PAF - Truck unload to direct placement	1,293	11,777,947	t/y	0.0001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
PAF - haul to stockpile	0	0	t/y	0.03	kg/t	203	t/load	249	Vehicle gros	0.85	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
PAF - Unload to stockpile	0	0	t/y	0.0001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
PAF - rehandle - Ex loading trucks	0	0	t/y	0.0001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
PAF - rehandle - Haul to pit	0	0	t/y	0.03	kg/t	203	t/load	249	Vehicle gros	0.85	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
PAF - rehandle - unload to pit	0	0	t/y	0.0001	kg/t	15.9	moisture cor	1.7	(wind speed/2.2)^1.3							
Ore																
Excavator loading truck	794.2	3,734,227	t/y	0.0003	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							30
Haul to MUP	104,010.5	3,734,227	t/y	0.19	kg/t	203	t/load	249	Vehicle gros	4.8	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
Unload at MUP	1,134.6	3,734,227	t/y	0.0003	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
FEL/Dozer at MUP	27,383	6,890	h/y	4.0	kg/h	7.7	moisture cor	13.0	silt content in %							
Ore Screening at MUP	4,108	3,734,227	t/y	0.0011	kg/t	0.0	0	0.0	0							
Product and Waste																
HMC - loading stockpiles	151.9	500,000	t/y	0.0003	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
HMC - loading trucks	151.9	500,000	t/y	0.0003	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
HMC - haul off-site	49,876	500,000	t/y	1.11	kg/t	45	t/load	51	Vehicle gros	13.0	km/return tri	3.8	kg/VKT	7.9	% silt conter	91
WHIMS Product Drying (Baghouse Stack)	27,909	18	m3/s	50.00	mg/m3											
WHIMS Product Screening	715	650,000	t/y	0.0011	kg/t											
Illmenite - loading trucks	197.5	650,000	t/y	0.0003	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
Illmenite - haul off-site	64,839	650,000	t/y	1.11	kg/t	45	t/load	51	Vehicle gros	13.0	km/return tri	3.8	kg/VKT	7.9	% silt conter	91
Tailings - loading trucks	4,059.0	2,023,710	t/y	0.0020	kg/t	2.0	moisture cor	1.7	(wind speed/2.2)^1.3							
Tailings - haulage to pit	132,287.3	2,023,710	t/y	0.44	kg/t	203	t/load	244	Vehicle gros	11.4	km/return tri	7.8	kg/VKT	7.9	% silt conter	85

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Tailings - unload to pit	4,059.0	2,023,710	t/y	0.0020	kg/t	2.0	moisture cor	1.7	(wind speed/2.2)^1.3							
Wind Erosion		0														
Active Pit	51,000	60	ha	0.1	kg/ha/h	8,760	h/y									0
NSOB Stockpile	39,100	46	ha	0.1	kg/ha/h	8,760	h/y									0
SOB Stockpile	59,500	70	ha	0.1	kg/ha/h	8,760	h/y									0
Soil Stockpile	34,000	40	ha	0.1	kg/ha/h	8,760	h/y									0
MUP Stockpile	3,825	5	ha	0.1	kg/ha/h	8,760	h/y									0
Product stockpiles	459	1	ha	0.1	kg/ha/h	8,760	h/y									0
Exposed tailings	8,011	9	ha	0.1	kg/ha/h	8,760	h/y									0
Miscellaneous																
Grader	95,496	155,160	km	0.6	kg/km	8	speed of gra	19,395	grader hours							
Total (kg/yr)	**1,968,362**															

YEAR 8 - PM10																
Source	**Emissions (kg/year)**	**Activity Intensity**	**Units**	**Emission Factor**	**Units**	**Equation Input Variables**										**Control %**
Soil stripping and re-handling																
Dozer clearing vegetation	1,294	900	h/y	1.4	kg/h	3.2	moisture coı	7.9	silt content in %							
Scraper stripping soil	22,864	1,314,000	t/yr	0.02	kg/t											
Scraper unload	15,768	1,314,000	t/yr	0.01	kg/t											
Soil Re-handle (excavator to truck)	694	1,430,962	t/yr	0.0005	kg/t	3.2	moisture coı	1.7	(wind speed/2.2)^1.3							
Soil Re-handle (haul to pit)	6,305	1,430,962	t/yr	0.03	kg/t	203	t/load	249	Vehicle gros	2.7	km/return tri	2.20	kg/VKT	7.9	% silt conter	85
Soil Re-handle (truck unload)	694	1,430,962	t/yr	0.0005	kg/t	3.2	moisture coı	1.7	(wind speed/2.2)^1.3							
Dozer soil spreading	1,409	980	h/y	1.4	kg/h	3.2	moisture coı	7.9	silt content in %							
Overburden																
Dozer on NSOB in pit	63,735	30,102	h/y	2.1	kg/h	8.5	moisture coı	25.0	silt content in %							
NSOB - Ex loading trucks	3,865	43,945,721	t/y	0.0001	kg/t	8.5	moisture coı	1.7	(wind speed/2.2)^1.3							30
NSOB - Haul to direct placement	179,036	39,896,840	t/y	0.03	kg/t	203	t/load	249	Vehicle gros	2.75	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
NSOB - unload to direct placement	5,013	39,896,840	t/y	0.0001	kg/t	8.5	moisture coı	1.7	(wind speed/2.2)^1.3							
NSOB - Haul to stockpile	18,169	4,048,881	t/y	0.03	kg/t	203	t/load	249	Vehicle gros	2.75	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
NSOB - unload to stockpile	509	4,048,881	t/y	0.0001	kg/t	8.5	moisture coı	1.7	(wind speed/2.2)^1.3							
NSOB - NP rehandle - Ex loading trucks	221	2,517,909	t/y	0.0001	kg/t	8.5	moisture coı	1.7	(wind speed/2.2)^1.3							30
NSOB - NP rehandle - Haul to pit	11,299	2,517,909	t/y	0.03	kg/t	203	t/load	249	Vehicle gros	2.75	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
NSOB - NP rehandle - unload to pit	316	2,517,909	t/y	0.0001	kg/t	8.5	moisture coı	1.7	(wind speed/2.2)^1.3							
NSOB - WB rehandle - Ex loading trucks	677	7,693,920	t/y	0.00	kg/t	8	moisture coı	2	(wind speed/2.2)^1.3							30
NSOB - WB rehandle - Haul to pit	45,198	7,693,920	t/y	0.04	kg/t	203	t/load	249	Vehicle gros	3.6	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
NSOB - WB rehandle - unload to pit	967	7,693,920	t/y	0.00	kg/t	8	moisture coı	2	(wind speed/2.2)^1.3							
Ore																
Excavator loading truck	388.6	3,863,484	t/y	0.0001	kg/t	7.7	moisture coı	1.7	(wind speed/2.2)^1.3							30
Haul onsite	61,783.6	3,863,484	t/y	0.11	kg/t	203	t/load	249	Vehicle gros	9.8	km/return tri	2.2	kg/VKT	7.9	% silt conter	85
Haul offsite	349,518.9	3,863,484	t/y	1.01	kg/t	203	t/load	249	Vehicle gros	92.4	km/return tri	2.2	kg/VKT	7.9	% silt conter	91
Unload at MUP	555.2	3,863,484	t/y	0.0001	kg/t	7.7	moisture coı	1.7	(wind speed/2.2)^1.3							
FEL/Dozer at MUP	11,340	12,489	h/y	0.9	kg/h	7.7	moisture coı	13.0	silt content in %							
Ore Screening at MUP	1,429	3,863,484	t/y	0.0004	kg/t											

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Product and Waste																
HMC - loading stockpiles	71.9	500,000	t/y	0.00	kg/t	8	moisture cor	2	(wind speed/2.2)^1.3							
HMC - loading trucks	71.9	500,000	t/y	0.00	kg/t	8	moisture cor	2	(wind speed/2.2)^1.3							
HMC - haul off-site	14,025.8	500,000	t/y	0.31	kg/t	45	t/load	51	Vehicle gros	13	km/return tri	1.1	kg/VKT	7.9	% silt conten	91
WHIMS Product Drying (Baghouse Stack)	27,909.4	18	m3/s	50.00	mg/m3											
WHIMS Product Screening	240.5	650,000	t/y	0.00	kg/t											
Illmenite - loading trucks	93.4	650,000	t/y	0.00	kg/t	8	moisture cor	2	(wind speed/2.2)^1.3							
Illmenite - haul off-site	18,233.5	650,000	t/y	0.31	kg/t	45	t/load	51	Vehicle gros	13	km/return tri	1.1	kg/VKT	7.9	% silt conten	91
Tailings - loading trucks	2,059.0	2,170,415	t/y	0.00	kg/t	2	moisture cor	2	(wind speed/2.2)^1.3							
Tailings - haulage to pit	56,696.4	2,170,415	t/y	0.17	kg/t	203	t/load	244	Vehicle gros	16.2	km/return tri	2.2	kg/VKT	7.9	% silt conten	85
Tailings - unload to pit	2,059.0	2,170,415	t/y	0.00	kg/t	2	moisture cor	2	(wind speed/2.2)^1.3							
Wind Erosion																
Active Pit	12,750	30	ha	0.05	kg/ha/h	8,760	h/y									
NSOB Stockpile	21,250	50	ha	0.05	kg/ha/h	8,760	h/y									
SOB Stockpile	29,750	70	ha	0.05	kg/ha/h	8,760	h/y									
Soil Stockpile	12,750	30	ha	0.05	kg/ha/h	8,760	h/y									
MUP Stockpile	1,913	5	ha	0.05	kg/ha/h	8,760	h/y									
Product stockpiles	213	1	ha	0.05	kg/ha/h	8,760	h/y									
Exposed tailings	3,995	9	ha	0.05	kg/ha/h	8,760	h/y									
Miscellaneous																
Grader	27,816	129,352	km	0.2	kg/km	8	speed of gra	16,169	grader hours							
Total (kg/yr)	**1,034,945**															

YEAR 8 - PM2.5

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Soil stripping and re-handling																
Dozer clearing vegetation	634	900	h/y	0.7	kg/h	3.2	moisture cor	7.9	silt content in %							
Scraper stripping soil	1,181	1,314,000	t/yr	0.00	kg/t											
Scraper unload	815	1,314,000	t/yr	0.00	kg/t											
Soil Re-handle (excavator to truck)	105	1,430,962	t/yr	0.0001	kg/t	3.2	moisture cor	1.7	(wind speed/2.2)^1.3							
Soil Re-handle (haul to pit)	630	1,430,962	t/yr	0.00	kg/t	203	t/load	249	Vehicle gros	2.7	km/return tri	0.22	kg/VKT	7.9	% silt conter	85
Soil Re-handle (truck unload)	105	1,430,962	t/yr	0.0001	kg/t	3.2	moisture cor	1.7	(wind speed/2.2)^1.3							
Dozer soil spreading	691	980	h/y	0.7	kg/h	3.2	moisture cor	7.9	silt content in %							
Overburden		0														
Dozer on NSOB in pit	24,305	30,102	h/y	0.8	kg/h	8.5	moisture cor	25.0	silt content in %							
NSOB - Ex loading trucks	585	43,945,721	t/y	0.0000	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
NSOB - Haul to direct placement	17,904	39,896,840	t/y	0.00	kg/t	203	t/load	249	Vehicle gros	2.75	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
NSOB - unload to direct placement	759	39,896,840	t/y	0.0000	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
NSOB - Haul to stockpile	1,817	4,048,881	t/y	0.00	kg/t	203	t/load	249	Vehicle gros	2.75	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
NSOB - unload to stockpile	77	4,048,881	t/y	0.0000	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
NSOB - NP rehandle - Ex loading trucks	34	2,517,909	t/y	0.0000	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							30
NSOB - NP rehandle - Haul to pit	1,130	2,517,909	t/y	0.00	kg/t	203	t/load	249	Vehicle gros	2.75	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
NSOB - NP rehandle - unload to pit	48	2,517,909	t/y	0.0000	kg/t	8.5	moisture cor	1.7	(wind speed/2.2)^1.3							
NSOB - WB rehandle - Ex loading trucks	102	7,693,920	t/y	0.00	kg/t	8	moisture cor	2	(wind speed/2.2)^1.3							30
NSOB - WB rehandle - Haul to pit	4,520	7,693,920	t/y	0.00	kg/t	203	t/load	249	Vehicle gros	3.6	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
NSOB - WB rehandle - unload to pit	146	7,693,920	t/y	0.00	kg/t	8	moisture cor	2	(wind speed/2.2)^1.3							
Ore		0														
Excavator loading truck	58.9	3,863,484	t/y	0.0000	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							30
Haul onsite	6,178.4	3,863,484	t/y	0.01	kg/t	203	t/load	249	Vehicle gros	9.8	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
Haul offsite	34,952	3,863,484	t/y	0.10	kg/t	203	t/load	249	Vehicle gros	92.4	km/return tri	0.2	kg/VKT	7.9	% silt conter	91
Unload at MUP	84.1	3,863,484	t/y	0.0000	kg/t	7.7	moisture cor	1.7	(wind speed/2.2)^1.3							
FEL/Dozer at MUP	5,212	12,489	h/y	0.4	kg/h	7.7	moisture cor	13.0	silt content in %							
Ore Screening at MUP	97	3,863,484	t/y	0.0000	kg/t											

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Product and Waste		0														
HMC - loading stockpiles	11	500,000	t/y	0.00	kg/t	8	moisture cor	2	(wind speed/2.2)^1.3							
HMC - loading trucks	11	500,000	t/y	0.00	kg/t	8	moisture cor	2	(wind speed/2.2)^1.3							
HMC - haul off-site	1,403	500,000	t/y	0.03	kg/t	45	t/load	51	Vehicle gros	13	km/return tri	0.1	kg/VKT	7.9	% silt conter	91
WHIMS Product Drying (Baghouse Stack)	27,909	18	m3/s	50.00	mg/m3											
WHIMS Product Screening	16	650,000	t/y	0.00	kg/t											
Illmenite - loading trucks	14	650,000	t/y	0.00	kg/t	8	moisture cor	2	(wind speed/2.2)^1.3							
Illmenite - haul off-site	1,823	650,000	t/y	0.03	kg/t	45	t/load	51	Vehicle gros	13	km/return tri	0.1	kg/VKT	7.9	% silt conter	91
Tailings - loading trucks	312	2,170,415	t/y	0.00	kg/t	2	moisture cor	2	(wind speed/2.2)^1.3							
Tailings - haulage to pit	5,670	2,170,415	t/y	0.02	kg/t	203	t/load	244	Vehicle gros	16.2	km/return tri	0.2	kg/VKT	7.9	% silt conter	85
Tailings - unload to pit	312	2,170,415	t/y	0.00	kg/t	2	moisture cor	2	(wind speed/2.2)^1.3							
Wind Erosion		0														
Active Pit	1,913	30	ha	0.01	kg/ha/h	8,760	h/y									0
NSOB Stockpile	3,188	50	ha	0.01	kg/ha/h	8,760	h/y									0
SOB Stockpile	4,463	70	ha	0.01	kg/ha/h	8,760	h/y									0
Soil Stockpile	1,913	30	ha	0.01	kg/ha/h	8,760	h/y									0
MUP Stockpile	287	4.5	ha	0.01	kg/ha/h	8,760	h/y									0
Product stockpiles	32	0.5	ha	0.01	kg/ha/h	8,760	h/y									0
Exposed tailings	599	9.4	ha	0.01	kg/ha/h	8,760	h/y									0
Miscellaneous		0														
Grader	27,816	129,352	km	0.2	kg/km	8	speed of gra	16,169	grader hours							
Total PM10 (kg/yr)	**179,860**															

YEAR 8 - TSP																
Source	**Emissions (kg/year)**	**Activity Intensity**	**Units**	**Emission Factor**	**Units**	**Equation Input Variables**										**Control %**
Soil stripping and re-handling																
Dozer clearing vegetation	6,042	900	h/y	6.7	kg/h	3.2	moisture co	7.9	silt content in %							
Scraper stripping soil	38,106	1,314,000	t/yr	0.03	kg/t											
Scraper unload	26,280	1,314,000	t/yr	0.02	kg/t											
Soil Re-handle (excavator to truck)	1,467	1,430,962	t/yr	0.0010	kg/t	3.2	moisture co	1.7	(wind speed/2.2)^1.3							
Soil Re-handle (haul to pit)	22,420	1,430,962	t/yr	0.10	kg/t	203	t/load	249	Vehicle gros	2.7	km/return tri	7.84	kg/VKT	7.9	% silt conter	85
Soil Re-handle (truck unload)	1,467	1,430,962	t/yr	0.0010	kg/t	3.2	moisture co	1.7	(wind speed/2.2)^1.3							
Dozer soil spreading	6,580	980	h/y	6.7	kg/h	3.2	moisture co	7.9	silt content in %							
Overburden																
Dozer on NSOB in pit	231,478	30,102	h/y	7.7	kg/h	8.5	moisture co	25.0	silt content in %							0
NSOB - Ex loading trucks	8,172	43,945,721	t/y	0.0003	kg/t	8.5	moisture co	1.7	(wind speed/2.2)^1.3							30
NSOB - Haul to direct placement	636,659	39,896,840	t/y	0.11	kg/t	203	t/load	249	Vehicle gros	2.75	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
NSOB - unload to direct placement	10,599	39,896,840	t/y	0.0003	kg/t	8.5	moisture co	1.7	(wind speed/2.2)^1.3							
NSOB - Haul to stockpile	64,611	4,048,881	t/y	0.11	kg/t	203	t/load	249	Vehicle gros	2.75	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
NSOB - unload to stockpile	1,076	4,048,881	t/y	0.0003	kg/t	8.5	moisture co	1.7	(wind speed/2.2)^1.3							0
NSOB - NP rehandle - Ex loading trucks	468	2,517,909	t/y	0.0003	kg/t	8.5	moisture co	1.7	(wind speed/2.2)^1.3							30
NSOB - NP rehandle - Haul to pit	40,180	2,517,909	t/y	0.11	kg/t	203	t/load	249	Vehicle gros	2.75	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
NSOB - NP rehandle - unload to pit	669	2,517,909	t/y	0.0003	kg/t	8.5	moisture co	1.7	(wind speed/2.2)^1.3							0
NSOB - WB rehandle - Ex loading trucks	1,431	7,693,920	t/y	0.00	kg/t	8	moisture co	2	(wind speed/2.2)^1.3							30
NSOB - WB rehandle - Haul to pit	530	7,693,920	t/y	0.00	kg/t	203	t/load	249	Vehicle gros	3.6	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
NSOB - WB rehandle - unload to pit	2,044	7,693,920	t/y	0.00	kg/t	8	moisture co	2	(wind speed/2.2)^1.3							0
Ore																
Excavator loading truck	821.7	3,863,484	t/y	0.0003	kg/t	7.7	moisture co	1.7	(wind speed/2.2)^1.3							30
Haul onsite	219,705.4	3,863,484	t/y	0.38	kg/t	203	t/load	249	Vehicle gros	9.8	km/return tri	7.8	kg/VKT	7.9	% silt conter	85
Haul offsite	1,242,904.6	3,863,484	t/y	3.57	kg/t	203	t/load	249	Vehicle gros	92.4	km/return tri	7.8	kg/VKT	7.9	% silt conter	91
Unload at MUP	1,173.8	3,863,484	t/y	0.0003	kg/t	7.7	moisture co	1.7	(wind speed/2.2)^1.3							
FEL/Dozer at MUP	49,636	12,489	h/y	4.0	kg/h	7.7	moisture co	13.0	silt content in %							
Ore Screening at MUP	4,250	3,863,484	t/y	0.0011	kg/t	0.0	0	0.0	0							

Source	Emissions (kg/year)	Activity Intensity	Units	Emission Factor	Units	Equation Input Variables										Control %
Product and Waste																
HMC - loading stockpiles	151.9	500,000	t/y	0.00	kg/t	8	moisture cor	2	(wind speed/2.2)^1.3							
HMC - loading trucks	151.9	500,000	t/y	0.00	kg/t	8	moisture cor	2	(wind speed/2.2)^1.3							
HMC - haul off-site	49,876.3	500,000	t/y	1.11	kg/t	45	t/load	51	Vehicle gros	13	km/return tri	3.8	kg/VKT	7.9	% silt conten	91
WHIMS Product Drying (Baghouse Stack)	27,909.4	18	m3/s	50.00	mg/m3											
WHIMS Product Screening	715.0	650,000	t/y	0.00	kg/t											
Illmenite - loading trucks	197.5	650,000	t/y	0.00	kg/t	8	moisture cor	2	(wind speed/2.2)^1.3							
Illmenite - haul off-site	64,839.2	650,000	t/y	1.11	kg/t	45	t/load	51	Vehicle gros	13	km/return tri	3.8	kg/VKT	7.9	% silt conten	91
Tailings - loading trucks	4,353.2	2,170,415	t/y	0.00	kg/t	2	moisture cor	2	(wind speed/2.2)^1.3							
Tailings - haulage to pit	201,615.0	2,170,415	t/y	0.62	kg/t	203	t/load	244	Vehicle gros	16.2	km/return tri	7.8	kg/VKT	7.9	% silt conten	85
Tailings - unload to pit	4,353.2	2,170,415	t/y	0.00	kg/t	2	moisture cor	2	(wind speed/2.2)^1.3							
Wind Erosion		0														
Active Pit	25,500	30	ha	0.10	kg/ha/h	8,760	h/y									0
NSOB Stockpile	42,500	50	ha	0.10	kg/ha/h	8,760	h/y									0
SOB Stockpile	59,500	70	ha	0.10	kg/ha/h	8,760	h/y									0
Soil Stockpile	25,500	30	ha	0.10	kg/ha/h	8,760	h/y									0
MUP Stockpile	3,825	5	ha	0.10	kg/ha/h	8,760	h/y									0
Product stockpiles	425	1	ha	0.10	kg/ha/h	8,760	h/y									0
Exposed tailings	7,990	9	ha	0.10	kg/ha/h	8,760	h/y									0
Miscellaneous		0														
Grader	79,612	129,352	km	0.6	kg/km	8	speed of gra	16,169	grader hours							
Total (kg/yr)	**3,217,782**															

Wheel Generated Dust - Control Efficiencies

A summary of control measures and associated control efficiencies from the literature is provided for the activity of wheel-generated dust.

Type of Measure	Control Measure	PM Control Efficiency	Reference
Source reduction	Usage of conveyors in place of haul roads	95%	Katestone (2011)
	Paving of the travel surface	>90%	MRI (2006) ; Bohn *et al.* (1978)
Surface improvement	Low silt aggregate	30%	Bohn *et al.* (1978)
	Application of geotextiles to gravel-surfaced haul roads	56-75%	Freeman (2006)
Wet suppression	Watering (standard procedure)	10% - 75%	MRI (2006)
	Level 1 watering : 2L/m²/hr	50%	NPI EETM Mining (2012)
	Level 2 watering : > 2L/m²/hr	75%	NPI EETM Mining (2012)
	Watering twice a day for industrial unpaved road	55%	MRI (2006)
	Watering on active coal mines	85%-95%	Cox et al (2014)
Surface treatment	Petroleum resin (after 5 months of application)	80%	US-EPA AP42 Chapter 13.2.2 Unpaved Roads (2006)
	Oil and double chip surface	80%	Bohn *et al.* (1978)
	Chemical suppression	84%	MRI (2006)
	Chemical suppression	40-98%	Foley *et al.* (1996)
	Hygroscopic salt application (control efficiency effectiveness over 14 days)	45%	Thompson *et al.* (2007)
	Hygroscopic salt application: (control efficiency effectiveness within 2 weeks)	82%	Thompson *et al.* (2007)
	Lignosulphonate application: (control efficiency effectiveness over 23 days)	66%	Thompson *et al.* (2007)

Type of Measure	Control Measure	PM Control Efficiency	Reference
	Lignosulphonate application: (control efficiency effectiveness over 23 days - upper bound)	70%	Thompson *et al.* (2007)
	Polymer emulsions (control efficiency effectiveness over 58 days)	70%	Thompson *et al.* (2007)
	Tar and bitumen emulsions (control efficiency effectiveness over 20 days)	70%	Thompson *et al.* (2007)
	Chemical suppression using EK35	63-94%+(a)	US-EPA (2006a)
	Chemical suppression using EnviroKleen	20-99%+(a)	US-EPA (2006b)
	Chemical suppression using DustGard	58-90%+(a)	US-EPA (2006c)
	Chemical suppression using PetroTac	73-94%(a)	US-EPA (2006d)
	Chemical suppression using Techsuppress	43->90%(a)	US-EPA (2006e)
Use of trucks with larger payloads	Usage of larger vehicles rather than smaller vehicles, 90t to 220t	40%	Katestone (2011)
	Usage of larger vehicles rather than smaller vehicles, 140t to 220t	20%	Katestone (2011)
	Usage of larger vehicles rather than smaller vehicles, 140t to 360t	45%	Katestone (2011)

(a) The dust control efficiency is published by particle size fraction as follows:

Product	Dust Control Efficiency (%)		
	Total Particulate Matter (TPM)	PM_{10}	$PM_{2.5}$
EK35	63 - 87	84 – 90	56 - 94+

Product	**Dust Control Efficiency (%)**		
	Total Particulate Matter (TPM)	**PM_{10}**	**$PM_{2.5}$**
EnviroKleen	78 - 99+	87 - 91+	20 - 87+
DustGard	75 - 86	88 - 90+	58 - 59
PetroTac	74 - 94	73 – 98	>90
Techsuppress	62 - 84	43 – 76	>90

Appendix E

Tabulated dispersion modelling results

YEAR 1										
	PM$_{10}$ concentration (μg/m^3)			PM$_{2.5}$ concentration (μg/m^3)			TSP concentration (μg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 μg/m^3)	Annual Ave (Goal = 30 μg/m^3)		24-Hour Max (Goal = 25 μg/m^3)	Annual Ave (Goal = 8 μg/m^3)		Annual Ave (Goal = 90 μg/m^3)		Annual Ave (Goal = 2 g/m^2/month)	Annual Average (Goal = 4 g/m^2/month)
Receptor ID	Increment	Increment	Cumulative (incl. background of 18.0 μg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 μg/m^3)	Increment	Cumulative (incl. background of 43.8 μg/m^3)	Increment	Cumulative (incl. background of 1.1 g/m^2/month)
Receptor Max	***24.7***	***3.8***	***21.8***	***4.6***	***0.8***	***7.3***	***7.0***	***50.8***	***0.2***	***1.3***
R1	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R2	10.4	0.7	18.7	1.8	0.1	6.6	1.0	44.8	0.01	1.15
R5	10.5	0.8	18.8	2.3	0.2	6.7	1.3	45.1	0.02	1.16
R7	6.6	0.7	18.7	1.3	0.1	6.6	1.1	44.9	0.02	1.16
R9	3.9	0.4	18.4	0.7	0.1	6.6	0.6	44.4	0.01	1.15
R10	3.8	0.4	18.4	0.7	0.1	6.6	0.6	44.4	0.01	1.15
R11	2.3	0.1	18.1	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R12	1.7	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R13	2.1	0.1	18.1	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R14	0.7	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R15	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R16	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R18	1.3	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R19	2.3	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R20	2.5	0.2	18.2	0.5	0.0	6.5	0.2	44.0	0.00	1.14
R21	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R22	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R24	4.5	0.4	18.4	0.7	0.1	6.6	0.7	44.5	0.01	1.15
R25	3.9	0.3	18.3	0.7	0.1	6.6	0.5	44.3	0.01	1.15
R26	2.4	0.3	18.3	0.4	0.1	6.6	0.4	44.2	0.01	1.15
R27	2.7	0.3	18.3	0.5	0.1	6.6	0.4	44.2	0.01	1.15
R28	3.3	0.3	18.3	0.6	0.1	6.6	0.4	44.2	0.01	1.15
R29	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R30	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R31	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R32	3.0	0.2	18.2	0.6	0.0	6.5	0.3	44.1	0.00	1.14
R36	12.8	1.8	19.8	2.4	0.4	6.9	3.1	46.9	0.06	1.20
R40	8.3	0.4	18.4	1.3	0.1	6.6	0.6	44.4	0.01	1.15
R41	7.0	0.4	18.4	1.2	0.1	6.6	0.6	44.4	0.01	1.15
R45	4.6	0.4	18.4	0.8	0.1	6.6	0.6	44.4	0.01	1.15
R54	5.5	0.4	18.4	1.0	0.1	6.6	0.6	44.4	0.01	1.15
R57	3.9	0.3	18.3	0.9	0.1	6.6	0.4	44.2	0.00	1.14
R59	2.6	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R60	2.5	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R62	2.6	0.2	18.2	0.4	0.1	6.6	0.4	44.2	0.00	1.14
R63	2.6	0.2	18.2	0.4	0.1	6.6	0.4	44.2	0.00	1.14
R77	3.3	0.3	18.3	0.6	0.1	6.6	0.4	44.2	0.01	1.15
R80	3.7	0.4	18.4	0.7	0.1	6.6	0.7	44.5	0.01	1.15
R85	4.6	0.3	18.3	0.9	0.1	6.6	0.6	44.4	0.01	1.15

Receptor ID	PM_{10} concentration (µg/m^3)			$PM_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	Annual Ave (Goal = 30 µg/m^3)		24-Hour Max (Goal = 25 µg/m^3)	Annual Ave (Goal = 8 µg/m^3)		Annual Ave (Goal = 90 µg/m^3)		Annual Ave (Goal = 2 g/m^2/month)	Annual Average (Goal = 4 g/m^2/month)
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.1 g/m^2/month)
R88	4.4	0.3	18.3	0.9	0.1	6.6	0.6	44.4	0.01	1.15
R92	9.2	0.8	18.8	1.8	0.2	6.7	1.4	45.2	0.03	1.17
R95	6.6	0.6	18.6	1.2	0.1	6.6	1.1	44.9	0.02	1.16
R108	4.5	0.3	18.3	0.9	0.1	6.6	0.5	44.3	0.01	1.15
R114	1.8	0.2	18.2	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R126	2.3	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R127	1.9	0.1	18.1	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R132	2.1	0.2	18.2	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R133	2.2	0.2	18.2	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R134	2.2	0.2	18.2	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R151	2.3	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R153	2.2	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R162	3.2	0.2	18.2	0.5	0.1	6.6	0.3	44.1	0.00	1.14
R168	2.1	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R170	2.3	0.2	18.2	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R171	2.3	0.1	18.1	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R174	2.5	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R175	2.4	0.1	18.1	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R177	2.4	0.2	18.2	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R192	2.1	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R193	2.1	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R194	2.0	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R195	2.0	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R197	2.0	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R200	2.0	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R202	2.2	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R203	2.1	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R208	2.3	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R213	2.2	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R217	2.4	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R219	2.4	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R220	2.4	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R221	2.5	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R222	2.5	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R223	2.5	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R224	2.5	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R225	2.5	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R226	2.5	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R227	2.5	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R228	2.4	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R229	2.5	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14

	PM_{10} concentration (µg/m³)			$PM_{2.5}$ concentration (µg/m³)			TSP concentration (µg/m³)		Dust Deposition (g/m²/month)	
	24-Hour Max (Goal = 50 µg/m³)	**Annual Ave (Goal = 30 µg/m³)**		**24-Hour Max (Goal = 25 µg/m³)**	**Annual Ave (Goal = 8 µg/m³)**		**Annual Ave (Goal = 90 µg/m³)**		**Annual Ave (Goal = 2 g/m²/month)**	**Annual Average (Goal = 4 g/m²/month)**
Receptor ID	Increment	Increment	Cumulative (incl. background of 18.0 µg/m³)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m³)	Increment	Cumulative (incl. background of 43.8 µg/m³)	Increment	Cumulative (incl. background of 1.1 g/m²/month)
R230	2.5	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R240	2.9	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R242	1.7	0.2	18.2	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R244	1.7	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R245	1.7	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R246	1.7	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R250	1.7	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R256	1.9	0.1	18.1	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R258	1.8	0.1	18.1	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R260	1.8	0.1	18.1	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R266	1.5	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R268	2.9	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R276	24.7	3.8	21.8	4.6	0.8	7.3	7.0	50.8	0.18	1.32
R277	19.9	2.9	20.9	3.9	0.6	7.1	5.3	49.1	0.12	1.26
R281	13.5	1.0	19.0	2.4	0.2	6.7	1.6	45.4	0.03	1.17
R284	3.2	0.2	18.2	0.5	0.1	6.6	0.4	44.2	0.00	1.14
R287	6.0	0.3	18.3	1.0	0.1	6.6	0.4	44.2	0.01	1.15
R291	7.0	0.3	18.3	1.2	0.1	6.6	0.4	44.2	0.01	1.15
R297	3.7	0.2	18.2	0.6	0.1	6.6	0.4	44.2	0.00	1.14
R300	2.8	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R303	4.3	0.2	18.2	0.7	0.1	6.6	0.4	44.2	0.01	1.15
R307	3.7	0.2	18.2	0.6	0.1	6.6	0.4	44.2	0.01	1.15
R310	3.7	0.2	18.2	0.6	0.1	6.6	0.4	44.2	0.01	1.15
R316	8.3	0.3	18.3	1.4	0.1	6.6	0.5	44.3	0.01	1.15
R319	3.3	0.3	18.3	0.6	0.1	6.6	0.4	44.2	0.01	1.15
R321	4.0	0.2	18.2	0.6	0.0	6.5	0.3	44.1	0.00	1.14
R322	4.1	0.2	18.2	0.7	0.0	6.5	0.3	44.1	0.00	1.14
R323	3.9	0.2	18.2	0.6	0.0	6.5	0.3	44.1	0.00	1.14
R329	4.2	0.2	18.2	0.7	0.0	6.5	0.3	44.1	0.00	1.14
R331	2.6	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R334	3.3	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R336	3.5	0.2	18.2	0.6	0.0	6.5	0.3	44.1	0.00	1.14
R342	3.1	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R343	3.1	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R351	4.6	0.2	18.2	0.8	0.1	6.6	0.4	44.2	0.00	1.14
R353	2.5	0.2	18.2	0.5	0.0	6.5	0.2	44.0	0.00	1.14
R357	2.4	0.2	18.2	0.5	0.0	6.5	0.2	44.0	0.00	1.14
R362	4.2	0.3	18.3	0.9	0.1	6.6	0.4	44.2	0.00	1.14
R366	6.2	0.4	18.4	1.2	0.1	6.6	0.6	44.4	0.00	1.14
R369	2.2	0.1	18.1	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R370	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14

	PM_{10} concentration (µg/m^3)			$PM_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	Annual Ave (Goal = 30 µg/m^3)		24-Hour Max (Goal = 25 µg/m^3)	Annual Ave (Goal = 8 µg/m^3)		Annual Ave (Goal = 90 µg/m^3)		Annual Ave (Goal = 2 g/m^2/month)	Annual Average (Goal = 4 g/m^2/month)
Receptor ID	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.1 g/m^2/month)
R375	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R376	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R378	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R380	1.7	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R386	1.7	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R389	2.1	0.1	18.1	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R393	3.1	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R402	10.8	0.7	18.7	1.8	0.1	6.6	1.0	44.8	0.01	1.15
R403	11.1	0.7	18.7	1.9	0.1	6.6	1.0	44.8	0.01	1.15
R405	8.6	0.7	18.7	1.5	0.1	6.6	1.1	44.9	0.01	1.15
R406	3.0	0.2	18.2	0.6	0.0	6.5	0.3	44.1	0.00	1.14
R414	1.3	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R415	1.3	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R419	1.7	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R421	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R422	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R423	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R424	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R425	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R426	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R427	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R433	1.4	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R437	1.3	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R445	1.3	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R455	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R470	0.6	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R478	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R479	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R485	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R488	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R489	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R492	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R496	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R508	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R509	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R510	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R511	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R516	2.0	0.1	18.1	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R525	1.3	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R527	0.8	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R531	0.8	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14

	PM_{10} concentration (µg/m^3)			$PM_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	**Annual Ave (Goal = 30 µg/m^3)**		**24-Hour Max (Goal = 25 µg/m^3)**	**Annual Ave (Goal = 8 µg/m^3)**		**Annual Ave (Goal = 90 µg/m^3)**		**Annual Ave (Goal = 2 g/m^2/month)**	**Annual Average (Goal = 4 g/m^2/month)**
Receptor ID	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.1 g/m^2/month)
R532	0.8	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R539	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R544	1.4	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R545	1.4	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R554	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R556	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R557	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R559	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R564	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R569	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R571	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R579	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R584	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R594	1.3	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R598	1.4	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R600	1.4	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R602	1.4	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R614	1.5	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R616	1.5	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R621	1.5	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R622	1.5	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R624	1.5	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R626	1.5	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R637	1.5	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R638	1.5	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R640	1.5	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R641	1.5	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R643	1.5	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R644	1.5	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R645	1.5	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R646	1.5	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R648	1.5	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R651	1.6	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R652	1.6	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R654	1.6	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R658	1.6	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R659	1.6	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R660	1.6	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R665	1.6	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R666	1.8	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R667	1.7	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14

	PM_{10} concentration (µg/m^3)			$PM_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	**Annual Ave (Goal = 30 µg/m^3)**		**24-Hour Max (Goal = 25 µg/m^3)**	**Annual Ave (Goal = 8 µg/m^3)**		**Annual Ave (Goal = 90 µg/m^3)**		**Annual Ave (Goal = 2 g/m^2/month)**	**Annual Average (Goal = 4 g/m^2/month)**
Receptor ID	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.1 g/m^2/month)
R675	1.5	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R676	1.5	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R677	1.6	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R678	1.5	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R681	1.4	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R682	1.3	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R684	1.4	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R685	1.4	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R686	1.4	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R687	1.4	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R688	1.4	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R690	1.4	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R691	1.4	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R694	1.5	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R695	1.5	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R697	1.5	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R701	1.4	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R703	1.4	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R714	1.6	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R716	2.0	0.1	18.1	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R717	2.0	0.1	18.1	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R722	2.1	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R724	2.0	0.2	18.2	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R726	2.1	0.2	18.2	0.3	0.0	6.5	0.3	44.1	0.00	1.14
R732	1.5	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R735	1.3	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R736	1.2	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R745	1.4	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R751	0.8	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R754	0.8	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R757	3.0	0.1	18.1	0.6	0.0	6.5	0.2	44.0	0.00	1.14
R760	2.2	0.2	18.2	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R767	1.3	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R768	1.3	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R771	0.8	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R772	0.7	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R777	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R778	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R781	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R794	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R796	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14

Receptor ID	PM$_{10}$ concentration (µg/m^3)			PM$_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	Annual Ave (Goal = 30 µg/m^3)		24-Hour Max (Goal = 25 µg/m^3)	Annual Ave (Goal = 8 µg/m^3)		Annual Ave (Goal = 90 µg/m^3)		Annual Ave (Goal = 2 g/m^2/month)	Annual Average (Goal = 4 g/m^2/month)
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.1 g/m^2/month)
R807	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R811	1.4	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R815	2.0	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R816	1.4	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R817	1.4	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R821	1.4	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R822	1.4	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R823	1.3	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R829	1.4	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R830	1.3	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R835	1.2	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R836	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R837	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R838	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R839	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R840	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R841	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R842	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R843	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R845	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R850	1.2	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R851	1.2	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R852	1.3	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R854	1.4	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R855	1.3	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R857	1.4	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R861	1.6	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R862	1.6	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R865	1.5	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R866	1.5	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R867	1.5	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R875	1.4	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R876	1.4	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R877	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R881	0.8	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R885	1.2	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R887	1.2	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R888	1.6	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R889	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R890	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R891	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14

	PM$_{10}$ concentration (µg/m^3)			PM$_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	**Annual Ave (Goal = 30 µg/m^3)**		**24-Hour Max (Goal = 25 µg/m^3)**	**Annual Ave (Goal = 8 µg/m^3)**		**Annual Ave (Goal = 90 µg/m^3)**		**Annual Ave (Goal = 2 g/m^2/month)**	**Annual Average (Goal = 4 g/m^2/month)**
Receptor ID	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.1 g/m^2/month)
R892	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R893	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R894	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R895	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R896	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R897	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R898	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R899	1.8	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R903	1.4	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R906	1.2	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R907	1.3	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R912	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R914	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R919	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R920	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R928	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R930	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R931	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R935	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R938	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R940	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R943	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R946	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R957	1.3	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R962	1.5	0.1	18.1	0.3	0.0	6.5	0.1	43.9	0.00	1.14
R968	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R969	0.6	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R970	0.6	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R971	0.8	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R972	0.8	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R976	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R988	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R989	1.2	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R999	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R1001	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R1008	0.4	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1012	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1017	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R1022	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R1027	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R1029	0.8	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14

	PM10 concentration (µg/m³)			PM2.5 concentration (µg/m³)			TSP concentration (µg/m³)		Dust Deposition (g/m²/month)	
	24-Hour Max (Goal = 50 µg/m³)	Annual Ave (Goal = 30 µg/m³)		24-Hour Max (Goal = 25 µg/m³)	Annual Ave (Goal = 8 µg/m³)		Annual Ave (Goal = 90 µg/m³)		Annual Ave (Goal = 2 g/m²/month)	Annual Average (Goal = 4 g/m²/month)
Receptor ID	Increment	Increment	Cumulative (incl. background of 18.0 µg/m³)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m³)	Increment	Cumulative (incl. background of 43.8 µg/m³)	Increment	Cumulative (incl. background of 1.1 g/m²/month)
R1030	0.8	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1031	0.8	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1032	0.8	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1033	0.8	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1034	0.8	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1035	0.8	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1036	0.7	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1037	0.7	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1038	0.7	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1039	0.7	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1040	0.7	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1041	0.7	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1042	2.6	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R1043	2.5	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R1044	2.6	0.2	18.2	0.5	0.0	6.5	0.3	44.1	0.00	1.14
R1045	2.2	0.2	18.2	0.4	0.0	6.5	0.3	44.1	0.00	1.14
R1046	1.5	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R1047	4.0	0.2	18.2	0.6	0.0	6.5	0.3	44.1	0.00	1.14
R1048	1.2	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14

YEAR 4										
	PM_{10} concentration (µg/m^3)			**$PM_{2.5}$ concentration (µg/m^3)**			**TSP concentration (µg/m^3)**		**Dust Deposition (g/m^2/month)**	
	24-Hour Max (Goal = 50 µg/m^3)	**Annual Ave (Goal = 30 µg/m^3)**		**24-Hour Max (Goal = 25 µg/m^3)**	**Annual Ave (Goal = 8 µg/m^3)**		**Annual Ave (Goal = 90 µg/m^3)**		**Annual Ave (Goal = 2 g/m^2/month)**	**Annual Average (Goal = 4 g/m^2/month)**
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.1 g/m^2/month)
Receptor Max	***43.9***	***4.4***	***22.4***	***5.9***	***1.2***	***7.7***	***7.1***	***50.9***	***0.1***	***1.2***
Receptor ID										
R1	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R2	9.5	1.2	19.2	1.6	0.3	6.8	2.0	45.8	0.03	1.17
R5	43.9	4.4	22.4	5.9	1.2	7.7	7.1	50.9	0.08	1.22
R7	3.1	0.4	18.4	0.5	0.1	6.6	0.6	44.4	0.01	1.15
R9	3.3	0.3	18.3	0.4	0.1	6.6	0.5	44.3	0.01	1.15
R10	3.3	0.3	18.3	0.4	0.1	6.6	0.5	44.3	0.01	1.15
R11	1.4	0.2	18.2	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R12	1.9	0.2	18.2	0.3	0.0	6.5	0.3	44.1	0.00	1.14
R13	3.2	0.2	18.2	0.6	0.1	6.6	0.3	44.1	0.00	1.14
R14	1.0	0.0	18.0	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R15	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R16	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R18	1.4	0.2	18.2	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R19	4.2	0.3	18.3	0.7	0.1	6.6	0.5	44.3	0.01	1.15
R20	2.9	0.3	18.3	0.5	0.1	6.6	0.5	44.3	0.00	1.14
R21	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R22	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R24	2.4	0.2	18.2	0.4	0.1	6.6	0.4	44.2	0.00	1.14
R25	2.3	0.2	18.2	0.3	0.1	6.6	0.3	44.1	0.00	1.14
R26	2.2	0.2	18.2	0.3	0.1	6.6	0.4	44.2	0.00	1.14
R27	2.2	0.2	18.2	0.3	0.1	6.6	0.3	44.1	0.00	1.14
R28	2.7	0.2	18.2	0.3	0.1	6.6	0.3	44.1	0.00	1.14
R29	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R30	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R31	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R32	3.0	0.3	18.3	0.5	0.1	6.6	0.4	44.2	0.00	1.14
R36	6.3	0.7	18.7	0.9	0.2	6.7	1.1	44.9	0.01	1.15
R40	2.6	0.2	18.2	0.4	0.1	6.6	0.3	44.1	0.00	1.14
R41	2.9	0.2	18.2	0.5	0.1	6.6	0.3	44.1	0.00	1.14
R45	2.4	0.2	18.2	0.3	0.1	6.6	0.4	44.2	0.00	1.14
R54	2.5	0.2	18.2	0.5	0.1	6.6	0.4	44.2	0.00	1.14
R57	1.8	0.2	18.2	0.3	0.0	6.5	0.3	44.1	0.00	1.14
R59	1.3	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R60	1.4	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R62	2.4	0.2	18.2	0.2	0.1	6.6	0.3	44.1	0.00	1.14
R63	2.4	0.2	18.2	0.2	0.1	6.6	0.3	44.1	0.00	1.14
R77	2.7	0.2	18.2	0.3	0.1	6.6	0.3	44.1	0.00	1.14
R80	3.8	0.3	18.3	0.5	0.1	6.6	0.5	44.3	0.01	1.15
R85	2.5	0.3	18.3	0.4	0.1	6.6	0.4	44.2	0.00	1.14
R88	2.6	0.3	18.3	0.4	0.1	6.6	0.4	44.2	0.00	1.14
R92	4.0	0.5	18.5	0.6	0.1	6.6	0.7	44.5	0.01	1.15
R95	3.1	0.4	18.4	0.5	0.1	6.6	0.6	44.4	0.01	1.15
R108	2.6	0.2	18.2	0.4	0.1	6.6	0.3	44.1	0.00	1.14

	PM_{10} concentration (μg/m^3)			$PM_{2.5}$ concentration (μg/m^3)			TSP concentration (μg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 μg/m^3)	Annual Ave (Goal = 30 μg/m^3)		24-Hour Max (Goal = 25 μg/m^3)	Annual Ave (Goal = 8 μg/m^3)		Annual Ave (Goal = 90 μg/m^3)		Annual Ave (Goal = 2 g/m^2/month)	Annual Average (Goal = 4 g/m^2/month)
	Increment	Increment	Cumulative (incl. background of 18.0 μg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 μg/m^3)	Increment	Cumulative (incl. background of 43.8 μg/m^3)	Increment	Cumulative (incl. background of 1.1 g/m^2/month)
R114	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R126	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R127	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R132	1.4	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R133	1.5	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R134	1.4	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R151	1.5	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R153	1.4	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R162	1.7	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R168	1.2	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R170	1.3	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R171	1.3	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R174	1.4	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R175	1.3	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R177	1.4	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R192	1.4	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R193	1.4	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R194	1.4	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R195	1.4	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R197	1.4	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R200	1.3	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R202	1.2	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R203	1.2	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R208	1.2	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R213	1.2	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R217	1.2	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R219	1.2	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R220	1.2	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R221	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R222	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R223	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R224	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R225	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R226	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R227	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R228	1.2	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R229	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R230	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R240	0.9	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R242	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R244	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R245	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R246	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R250	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R256	1.2	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R258	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14

	PM10 concentration (µg/m³)			PM2.5 concentration (µg/m³)			TSP concentration (µg/m³)		Dust Deposition (g/m²/month)	
	24-Hour Max (Goal = 50 µg/m³)	Annual Ave (Goal = 30 µg/m³)		24-Hour Max (Goal = 25 µg/m³)	Annual Ave (Goal = 8 µg/m³)		Annual Ave (Goal = 90 µg/m³)		Annual Ave (Goal = 2 g/m²/month)	Annual Average (Goal = 4 g/m²/month)
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m³)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m³)	Increment	Cumulative (incl. background of 43.8 µg/m³)	Increment	Cumulative (incl. background of 1.1 g/m²/month)
R260	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R266	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R268	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R276	8.8	0.8	18.8	1.3	0.2	6.7	1.3	45.1	0.02	1.16
R277	8.9	0.8	18.8	1.3	0.2	6.7	1.3	45.1	0.02	1.16
R281	4.0	0.9	18.9	0.7	0.2	6.7	1.6	45.4	0.03	1.17
R284	1.2	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R287	1.9	0.2	18.2	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R291	2.1	0.2	18.2	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R297	1.2	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R300	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R303	1.7	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R307	1.3	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R310	1.3	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R316	2.2	0.2	18.2	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R319	1.5	0.2	18.2	0.3	0.0	6.5	0.3	44.1	0.00	1.14
R321	0.9	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R322	0.8	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R323	0.9	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R329	1.7	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R331	1.7	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R334	2.7	0.1	18.1	0.4	0.0	6.5	0.2	44.0	0.00	1.14
R336	3.3	0.1	18.1	0.5	0.0	6.5	0.2	44.0	0.00	1.14
R342	1.3	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R343	1.3	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R351	1.8	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R353	2.9	0.3	18.3	0.5	0.1	6.6	0.5	44.3	0.00	1.14
R357	2.9	0.3	18.3	0.5	0.1	6.6	0.5	44.3	0.00	1.14
R362	8.3	0.6	18.6	1.3	0.2	6.7	1.0	44.8	0.01	1.15
R366	4.6	0.4	18.4	0.8	0.1	6.6	0.7	44.5	0.01	1.15
R369	1.5	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R370	1.6	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R375	1.6	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R376	1.6	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R378	1.6	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R380	1.3	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R386	1.4	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R389	1.9	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R393	1.4	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R402	9.6	1.3	19.3	1.6	0.3	6.8	2.0	45.8	0.03	1.17
R403	9.6	1.3	19.3	1.6	0.3	6.8	2.0	45.8	0.03	1.17
R405	9.3	1.2	19.2	1.5	0.3	6.8	1.9	45.7	0.02	1.16
R406	3.0	0.3	18.3	0.5	0.1	6.6	0.4	44.2	0.00	1.14
R414	1.4	0.2	18.2	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R415	1.4	0.2	18.2	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R419	1.9	0.2	18.2	0.3	0.0	6.5	0.3	44.1	0.00	1.14

	PM_{10} concentration (µg/m^3)			$PM_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	Annual Ave (Goal = 30 µg/m^3)		24-Hour Max (Goal = 25 µg/m^3)	Annual Ave (Goal = 8 µg/m^3)		Annual Ave (Goal = 90 µg/m^3)		Annual Ave (Goal = 2 g/m^2/month)	Annual Average (Goal = 4 g/m^2/month)
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.1 g/m^2/month)
R421	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R422	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R423	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R424	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R425	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R426	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R427	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R433	0.9	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R437	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R445	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R455	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R470	0.6	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R478	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R479	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R485	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R488	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R489	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R492	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R496	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R508	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R509	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R510	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R511	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R516	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R525	1.1	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R527	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R531	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R532	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R539	1.4	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R544	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R545	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R554	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R556	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R557	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R559	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R564	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R569	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R571	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R579	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R584	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R594	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R598	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R600	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R602	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R614	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R616	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14

	PM10 concentration (µg/m³)			PM2.5 concentration (µg/m³)			TSP concentration (µg/m³)		Dust Deposition (g/m²/month)	
	24-Hour Max (Goal = 50 µg/m³)	Annual Ave (Goal = 30 µg/m³)		24-Hour Max (Goal = 25 µg/m³)	Annual Ave (Goal = 8 µg/m³)		Annual Ave (Goal = 90 µg/m³)		Annual Ave (Goal = 2 g/m²/month)	Annual Average (Goal = 4 g/m²/month)
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m³)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m³)	Increment	Cumulative (incl. background of 43.8 µg/m³)	Increment	Cumulative (incl. background of 1.1 g/m²/month)
R621	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R622	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R624	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R626	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R637	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R638	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R640	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R641	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R643	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R644	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R645	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R646	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R648	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R651	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R652	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R654	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R658	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R659	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R660	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R665	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R666	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R667	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R675	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R676	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R677	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R678	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R681	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R682	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R684	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R685	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R686	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R687	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R688	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R690	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R691	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R694	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R695	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R697	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R701	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R703	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R714	1.7	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R716	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R717	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R722	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R724	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R726	1.5	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14

	PM$_{10}$ concentration (µg/m^3)			PM$_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	Annual Ave (Goal = 30 µg/m^3)		24-Hour Max (Goal = 25 µg/m^3)	Annual Ave (Goal = 8 µg/m^3)		Annual Ave (Goal = 90 µg/m^3)		Annual Ave (Goal = 2 g/m^2/month)	Annual Average (Goal = 4 g/m^2/month)
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.1 g/m^2/month)
R732	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R735	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R736	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R745	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R751	0.5	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R754	0.5	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R757	1.4	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R760	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R767	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R768	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R771	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R772	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R777	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R778	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R781	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R794	0.5	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R796	0.5	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R807	0.4	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R811	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R815	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R816	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R817	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R821	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R822	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R823	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R829	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R830	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R835	1.2	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R836	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R837	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R838	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R839	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R840	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R841	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R842	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R843	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R845	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R850	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R851	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R852	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R854	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R855	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R857	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R861	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R862	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R865	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14

	PM$_{10}$ concentration (µg/m^3)			PM$_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	Annual Ave (Goal = 30 µg/m^3)		24-Hour Max (Goal = 25 µg/m^3)	Annual Ave (Goal = 8 µg/m^3)		Annual Ave (Goal = 90 µg/m^3)		Annual Ave (Goal = 2 g/m^2/month)	Annual Average (Goal = 4 g/m^2/month)
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.1 g/m^2/month)
R866	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R867	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R875	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R876	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R877	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R881	0.4	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R885	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R887	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R888	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R889	0.5	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R890	0.5	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R891	0.5	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R892	0.5	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R893	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R894	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R895	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R896	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R897	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R898	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R899	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R903	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R906	0.9	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R907	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R912	1.0	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R914	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R919	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R920	0.9	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R928	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R930	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R931	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R935	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R938	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R940	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R943	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R946	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R957	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R962	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R968	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R969	0.4	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R970	0.4	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R971	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R972	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R976	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R988	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R989	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R999	0.8	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14

	PM$_{10}$ concentration (µg/m^3)			PM$_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	**Annual Ave (Goal = 30 µg/m^3)**		**24-Hour Max (Goal = 25 µg/m^3)**	**Annual Ave (Goal = 8 µg/m^3)**		**Annual Ave (Goal = 90 µg/m^3)**		**Annual Ave (Goal = 2 g/m^2/month)**	**Annual Average (Goal = 4 g/m^2/month)**
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.1 g/m^2/month)
R1001	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1008	0.4	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1012	0.7	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1017	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1022	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1027	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1029	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1030	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1031	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1032	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1033	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1034	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1035	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1036	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1037	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1038	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1039	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1040	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1041	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1042	1.5	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R1043	1.5	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R1044	1.5	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R1045	1.3	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R1046	1.0	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R1047	1.7	0.1	18.1	0.3	0.0	6.5	0.2	44.0	0.00	1.14
R1048	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14

YEAR 8										
	PM_{10} concentration (µg/m^3)			$PM_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	**Annual Ave (Goal = 30 µg/m^3)**		**24-Hour Max (Goal = 25 µg/m^3)**	**Annual Ave (Goal = 8 µg/m^3)**		**Annual Ave (Goal = 90 µg/m^3)**		**Annual Ave (Goal = 2 g/m^2/month)**	**Annual Average (Goal = 4 g/m^2/month)**
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.14 g/m^2/month)
Receptor Max	***20.8***	***7.0***	***25.0***	***6.5***	***0.6***	***7.1***	***8.5***	***52.3***	***0.2***	***1.3***
Receptor ID										
R1	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R16	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R30	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R478	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R479	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R485	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R488	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R489	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R492	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R496	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R508	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R509	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R510	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R511	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R877	0.0	0.0	18.0	0.0	0.0	6.5	0.0	43.8	0.00	1.14
R969	0.2	0.0	18.0	0.0	0.0	6.5	0.1	43.9	0.00	1.14
R970	0.2	0.0	18.0	0.0	0.0	6.5	0.1	43.9	0.00	1.14
R892	0.2	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R889	0.2	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R890	0.2	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R891	0.2	0.0	18.0	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1022	0.2	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1027	0.2	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R807	0.2	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1008	0.2	0.0	18.0	0.0	0.0	6.5	0.1	43.9	0.00	1.14
R794	0.2	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R796	0.2	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R781	0.2	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R778	0.2	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R777	0.2	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1017	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R881	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R957	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R989	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R988	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R962	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1001	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R999	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R976	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R946	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14

	PM$_{10}$ concentration (µg/m^3)			PM$_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	**Annual Ave (Goal = 30 µg/m^3)**		**24-Hour Max (Goal = 25 µg/m^3)**	**Annual Ave (Goal = 8 µg/m^3)**		**Annual Ave (Goal = 90 µg/m^3)**		**Annual Ave (Goal = 2 g/m^2/month)**	**Annual Average (Goal = 4 g/m^2/month)**
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.14 g/m^2/month)
R943	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R899	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R968	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R930	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R931	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R940	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R938	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R935	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1033	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1032	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1031	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R919	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1030	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1029	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1034	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R920	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R928	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1035	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R912	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R914	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R564	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1041	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R888	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1038	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1037	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1039	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1036	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1040	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R845	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R584	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R852	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R850	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R754	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R772	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R751	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R851	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R855	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R854	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R823	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R897	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R898	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R896	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R895	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14

	PM$_{10}$ concentration (µg/m^3)			PM$_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	**Annual Ave (Goal = 30 µg/m^3)**		**24-Hour Max (Goal = 25 µg/m^3)**	**Annual Ave (Goal = 8 µg/m^3)**		**Annual Ave (Goal = 90 µg/m^3)**		**Annual Ave (Goal = 2 g/m^2/month)**	**Annual Average (Goal = 4 g/m^2/month)**
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.14 g/m^2/month)
R893	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R894	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R830	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R822	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R554	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R571	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R821	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R971	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R857	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R972	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R816	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R569	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R817	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R579	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R840	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R829	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R837	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R556	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R843	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R557	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R842	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R839	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R838	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R841	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R887	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R559	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R885	0.3	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R835	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R771	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R866	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R867	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R865	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R836	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R815	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R544	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R545	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R862	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R861	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R768	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R1012	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R767	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R678	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R677	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14

	PM_{10} concentration ($\mu g/m^3$)			$PM_{2.5}$ concentration ($\mu g/m^3$)			TSP concentration ($\mu g/m^3$)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 $\mu g/m^3$)	Annual Ave (Goal = 30 $\mu g/m^3$)		24-Hour Max (Goal = 25 $\mu g/m^3$)	Annual Ave (Goal = 8 $\mu g/m^3$)		Annual Ave (Goal = 90 $\mu g/m^3$)		Annual Ave (Goal = 2 g/m^2/month)	Annual Average (Goal = 4 g/m^2/month)
	Increment	Increment	Cumulative (incl. background of 18.0 $\mu g/m^3$)	Increment	Increment	Cumulative (incl. background of 6.5 $\mu g/m^3$)	Increment	Cumulative (incl. background of 43.8 $\mu g/m^3$)	Increment	Cumulative (incl. background of 1.14 g/m^2/month)
R659	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R682	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R676	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R681	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R660	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R687	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R686	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R675	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R685	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R684	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R665	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R688	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R648	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R658	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R667	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R652	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R701	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R643	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R654	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R644	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R645	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R641	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R651	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R646	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R666	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R638	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R703	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R640	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R637	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R626	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R697	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R621	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R695	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R694	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R622	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R598	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R614	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R624	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R433	0.4	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R616	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R602	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R600	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R594	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14

	PM10 concentration (µg/m³)			PM2.5 concentration (µg/m³)			TSP concentration (µg/m³)		Dust Deposition (g/m²/month)	
	24-Hour Max (Goal = 50 µg/m³)	Annual Ave (Goal = 30 µg/m³)		24-Hour Max (Goal = 25 µg/m³)	Annual Ave (Goal = 8 µg/m³)		Annual Ave (Goal = 90 µg/m³)		Annual Ave (Goal = 2 g/m²/month)	Annual Average (Goal = 4 g/m²/month)
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m³)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m³)	Increment	Cumulative (incl. background of 43.8 µg/m³)	Increment	Cumulative (incl. background of 1.14 g/m²/month)
R907	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R690	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R691	0.4	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R378	0.5	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R370	0.5	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R906	0.5	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R375	0.5	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R376	0.5	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R714	0.5	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R716	0.5	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R717	0.5	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R903	0.5	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R875	0.5	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R876	0.5	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R539	0.5	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R470	0.5	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R760	0.5	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R745	0.5	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R437	0.5	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R525	0.5	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R445	0.5	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R342	0.5	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R343	0.6	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R724	0.6	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R722	0.6	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R735	0.6	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R811	0.6	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R455	0.6	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R736	0.6	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R1048	0.6	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R389	0.6	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R726	0.6	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R516	0.6	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R127	0.6	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R393	0.6	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R380	0.6	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R386	0.6	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R531	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R532	0.7	0.1	18.1	0.1	0.0	6.5	0.1	43.9	0.00	1.14
R732	0.7	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R114	0.7	0.2	18.2	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R369	0.7	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R27	0.7	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14

	PM$_{10}$ concentration (µg/m^3)			PM$_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	**Annual Ave (Goal = 30 µg/m^3)**		**24-Hour Max (Goal = 25 µg/m^3)**	**Annual Ave (Goal = 8 µg/m^3)**		**Annual Ave (Goal = 90 µg/m^3)**		**Annual Ave (Goal = 2 g/m^2/month)**	**Annual Average (Goal = 4 g/m^2/month)**
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.14 g/m^2/month)
R63	0.7	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R62	0.7	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R77	0.7	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R28	0.7	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R59	0.7	0.2	18.2	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R757	0.8	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R22	0.8	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R21	0.8	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R14	0.8	0.1	18.1	0.2	0.0	6.5	0.1	43.9	0.00	1.14
R60	0.8	0.2	18.2	0.1	0.0	6.5	0.3	44.1	0.00	1.14
R132	0.8	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R26	0.8	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R256	0.8	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R88	0.8	0.3	18.3	0.2	0.1	6.6	0.4	44.2	0.00	1.14
R134	0.8	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R85	0.8	0.3	18.3	0.2	0.1	6.6	0.4	44.2	0.00	1.14
R126	0.8	0.2	18.2	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R319	0.8	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R133	0.9	0.1	18.1	0.1	0.0	6.5	0.2	44.0	0.00	1.14
R258	0.9	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R260	0.9	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R266	0.9	0.2	18.2	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R268	0.9	0.2	18.2	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R25	1.0	0.3	18.3	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R336	1.0	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R331	1.0	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R334	1.0	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R244	1.0	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R245	1.0	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R246	1.0	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R10	1.0	0.3	18.3	0.3	0.1	6.6	0.5	44.3	0.00	1.14
R250	1.0	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R9	1.0	0.3	18.3	0.3	0.1	6.6	0.5	44.3	0.00	1.14
R242	1.0	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R1046	1.0	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R329	1.0	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R1045	1.1	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R174	1.1	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R240	1.1	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R175	1.1	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R171	1.1	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R80	1.1	0.3	18.3	0.3	0.1	6.6	0.5	44.3	0.00	1.14
R527	1.1	0.1	18.1	0.2	0.0	6.5	0.2	44.0	0.00	1.14

	PM$_{10}$ concentration (µg/m^3)			PM$_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	**Annual Ave (Goal = 30 µg/m^3)**		**24-Hour Max (Goal = 25 µg/m^3)**	**Annual Ave (Goal = 8 µg/m^3)**		**Annual Ave (Goal = 90 µg/m^3)**		**Annual Ave (Goal = 2 g/m^2/month)**	**Annual Average (Goal = 4 g/m^2/month)**
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.14 g/m^2/month)
R170	1.1	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R168	1.1	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R177	1.1	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R1044	1.1	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R322	1.1	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R323	1.1	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R321	1.1	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R1047	1.1	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R351	1.1	0.2	18.2	0.2	0.0	6.5	0.3	44.1	0.00	1.14
R1042	1.2	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R1043	1.2	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R29	1.2	0.2	18.2	0.2	0.0	6.5	0.2	44.0	0.00	1.14
R353	1.2	0.2	18.2	0.4	0.1	6.6	0.4	44.2	0.00	1.14
R303	1.2	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R151	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R357	1.3	0.2	18.2	0.4	0.1	6.6	0.4	44.2	0.00	1.14
R287	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R316	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R153	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R193	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R24	1.3	0.4	18.4	0.2	0.1	6.6	0.6	44.4	0.00	1.14
R291	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R307	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R192	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R195	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R310	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R197	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R300	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R194	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R20	1.3	0.2	18.2	0.4	0.1	6.6	0.4	44.2	0.00	1.14
R230	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R221	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R222	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R223	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R220	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R219	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R229	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R217	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R228	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R227	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R226	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R225	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R224	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14

	PM_{10} concentration (µg/m^3)			$PM_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	**Annual Ave (Goal = 30 µg/m^3)**		**24-Hour Max (Goal = 25 µg/m^3)**	**Annual Ave (Goal = 8 µg/m^3)**		**Annual Ave (Goal = 90 µg/m^3)**		**Annual Ave (Goal = 2 g/m^2/month)**	**Annual Average (Goal = 4 g/m^2/month)**
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.14 g/m^2/month)
R297	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R213	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R208	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R203	1.3	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R202	1.4	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R200	1.4	0.2	18.2	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R284	1.4	0.3	18.3	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R162	1.4	0.3	18.3	0.2	0.0	6.5	0.4	44.2	0.00	1.14
R40	1.6	0.3	18.3	0.3	0.1	6.6	0.5	44.3	0.00	1.14
R41	1.7	0.4	18.4	0.3	0.1	6.6	0.6	44.4	0.00	1.14
R45	1.7	0.4	18.4	0.3	0.1	6.6	0.7	44.5	0.00	1.14
R423	1.7	0.3	18.3	0.4	0.1	6.6	0.4	44.2	0.00	1.14
R422	1.7	0.3	18.3	0.5	0.1	6.6	0.4	44.2	0.00	1.14
R31	1.7	0.3	18.3	0.5	0.1	6.6	0.4	44.2	0.00	1.14
R427	1.7	0.3	18.3	0.5	0.1	6.6	0.4	44.2	0.00	1.14
R426	1.7	0.3	18.3	0.5	0.1	6.6	0.4	44.2	0.00	1.14
R424	1.7	0.3	18.3	0.5	0.1	6.6	0.4	44.2	0.00	1.14
R18	1.7	0.3	18.3	0.4	0.1	6.6	0.4	44.2	0.00	1.14
R415	1.7	0.3	18.3	0.4	0.1	6.6	0.4	44.2	0.00	1.14
R414	1.7	0.3	18.3	0.4	0.1	6.6	0.4	44.2	0.00	1.14
R421	1.7	0.3	18.3	0.5	0.1	6.6	0.4	44.2	0.00	1.14
R425	1.7	0.3	18.3	0.5	0.1	6.6	0.4	44.2	0.00	1.14
R92	1.8	0.6	18.6	0.4	0.1	6.6	1.0	44.8	0.00	1.14
R19	1.8	0.5	18.5	0.5	0.1	6.6	1.0	44.8	0.00	1.14
R366	1.8	0.3	18.3	0.5	0.1	6.6	0.5	44.3	0.00	1.14
R95	1.9	0.6	18.6	0.3	0.1	6.6	0.9	44.7	0.00	1.14
R7	1.9	0.6	18.6	0.3	0.1	6.6	0.9	44.7	0.00	1.14
R36	2.3	0.9	18.9	0.5	0.1	6.6	1.4	45.2	0.00	1.14
R362	2.5	0.4	18.4	1.0	0.1	6.6	0.6	44.4	0.00	1.14
R15	2.6	0.3	18.3	0.5	0.1	6.6	0.3	44.1	0.00	1.14
R57	2.7	0.5	18.5	0.4	0.1	6.6	0.8	44.6	0.01	1.15
R277	2.9	1.1	19.1	0.7	0.2	6.7	1.8	45.6	0.01	1.15
R108	3.0	0.5	18.5	0.4	0.1	6.6	0.8	44.6	0.01	1.15
R32	3.1	1.0	19.0	0.6	0.2	6.7	2.3	46.1	0.03	1.17
R406	3.2	1.1	19.1	0.6	0.2	6.7	2.3	46.1	0.03	1.17
R11	3.3	0.6	18.6	0.7	0.1	6.6	0.7	44.5	0.00	1.14
R276	3.3	1.3	19.3	0.7	0.2	6.7	2.1	45.9	0.02	1.16
R403	3.6	0.6	18.6	1.1	0.1	6.6	1.0	44.8	0.01	1.15
R402	3.7	0.6	18.6	1.1	0.1	6.6	1.0	44.8	0.01	1.15
R2	3.7	0.6	18.6	1.1	0.1	6.6	1.0	44.8	0.01	1.15
R12	3.8	0.7	18.7	0.8	0.1	6.6	0.8	44.6	0.00	1.14
R419	3.8	0.7	18.7	0.8	0.1	6.6	0.8	44.6	0.00	1.14
R405	4.3	0.6	18.6	1.3	0.1	6.6	0.9	44.7	0.01	1.15

	PM_{10} concentration (µg/m^3)			$PM_{2.5}$ concentration (µg/m^3)			TSP concentration (µg/m^3)		Dust Deposition (g/m^2/month)	
	24-Hour Max (Goal = 50 µg/m^3)	Annual Ave (Goal = 30 µg/m^3)		24-Hour Max (Goal = 25 µg/m^3)	Annual Ave (Goal = 8 µg/m^3)		Annual Ave (Goal = 90 µg/m^3)		Annual Ave (Goal = 2 g/m^2/month)	Annual Average (Goal = 4 g/m^2/month)
	Increment	Increment	Cumulative (incl. background of 18.0 µg/m^3)	Increment	Increment	Cumulative (incl. background of 6.5 µg/m^3)	Increment	Cumulative (incl. background of 43.8 µg/m^3)	Increment	Cumulative (incl. background of 1.14 g/m^2/month)
R54	4.6	0.8	18.8	0.6	0.1	6.6	1.3	45.1	0.02	1.16
R13	5.1	1.9	19.9	0.8	0.3	6.8	3.9	47.7	0.07	1.21
R5	16.2	1.8	19.8	6.5	0.6	7.1	2.8	46.6	0.03	1.17
R281	20.8	7.0	25.0	1.8	0.6	7.1	8.5	52.3	0.2	1.3

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