SINCLAIR KNIGHT MERZ
SKM

Mt Piper Power Station Ash Placement Project

AIR QUALITY ASSESSMENT

- Final
- August 2010

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1. Introduction

1.1. Background

Delta Electricity owns and operates Mt Piper Power Station (MPPS), located approximately 17 kilometres (km) northwest of Lithgow. The station currently comprises two coal-fired generating units, each of which is operating at 700 megawatts (MW).

The original development consent for Mt Piper in 1982 included a proposal to place ash produced at the station in an ash dam – i.e. a wet system. Due to a deferment in construction of Mt Piper, the opportunity for an alternative ash placement arose and, based on the Environmental Impact Station (EIS) prepared in November 1989, consent was granted by Lithgow City Council in March 1990 for ash placement in a former Western Main open cut mine void adjacent to the power station. This area is known as Area 1 and employs basically dry ash placement. Currently approximately 786,000 cubic metres (m^3) of ash is placed in Area 1 annually.

Concept Plan approval has been granted for the construction and operation of the Mt Piper extension project on a site next to the existing power station. Should this proceed it would result in new generating capacity of about 2,000 MW using either coal or gas as the fuel source. The present ash placement area is expected to reach capacity in five to six years (by around 2015), well before the existing power station reached the end of its economical life. Accordingly there is a need to obtain development consent for ash placement from the existing power station beyond that time. Should Mt Piper Extension proceed as a coal fired plant, there will also be a need to provide storage areas for the ash from the existing and proposed new plant.

The Mount Piper Ash Placement Project (the 'Project'), involves the development of new ash placement areas to cater for the ash generated from the existing Mount Piper Power Station and to accommodate ash from the proposed Mount Piper Extension Project. The Project involves four proposed areas for ash placement which include the Lamberts North site, Lamberts South site, Ivanhoe No 4 site, and Neubecks Creek.

1.2. Purpose of the Report

This report has been prepared by SKM for Delta Electricity. The purpose of the report is to assess the air quality impact of the Mt Piper Ash Placement Project, for inclusion into the Environmental Assessment.

The Director-General's requirements for air quality assessment within the EA were:

Air quality impacts for the Neubecks Creek and Ivanhoe 4 sites (concept plan application only) include an analysis of potential air quality impacts and constraints to the development of these *sites including available mitigation and/or management options that may be applied to achieve acceptable environmental outcomes (such as low dust generation ash disposal options), with consideration of cumulative impacts from the project and other existing or proposed activities in close proximity to the project site. Key air quality risk factors and/or design criteria that would require further detailed investigation prior to the development of these sites must be identified.*

For the Lamberts North and Lamberts South Sites (project application), include an assessment of the air quality impacts of the proposed development in accordance with the Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales (DECC, 2005) (Approved Methods) considering worst case operating scenarios and meteorological conditions, representative monitoring and receiver locations and cumulative impacts from nearby activities (e.g. Mount Piper and Wallerawang Power Stations). The assessment must focus on potential point source emissions, odour impacts, and particulate impacts during construction and operation as well as contaminants in the ash. Detailed information for the proposed mitigation and management measures proposed to minimise identified impacts relevant to the project application must be provided.

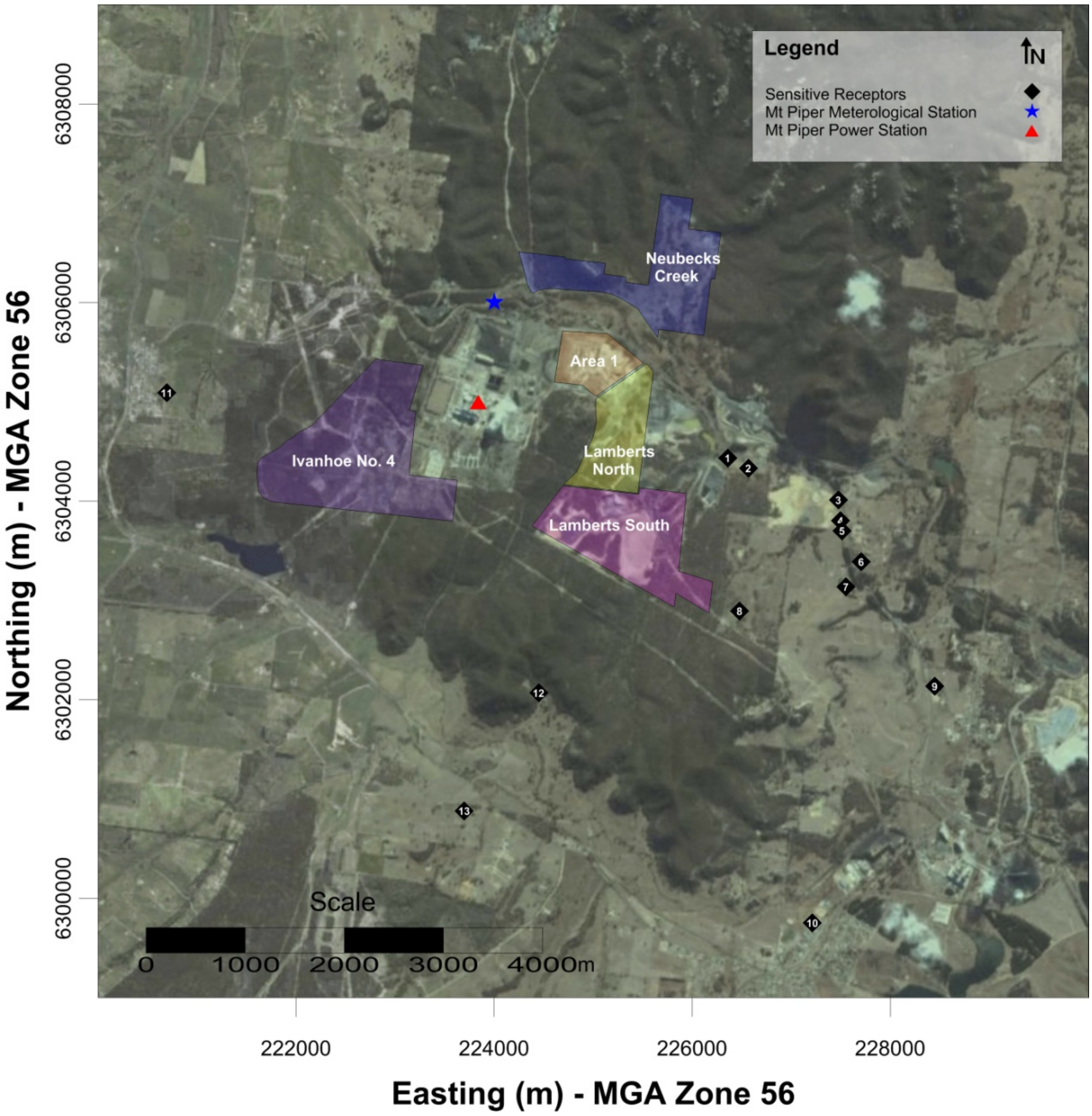
In accordance with the Director General's Requirements this report provides a qualitative air quality assessment of the Neubecks Creek and Ivanhoe sites and a quantitative air quality assessment for the Lamberts North and Lamberts South sites. The assessment follows the procedures outlined by the NSW Department of Environment and Climate Change and Water (DECCW) in their document titled *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005).

2. Project Description

2.1. Project Description and Staging

Delta Electricity has identified a need to expand its current ash placement facilities. Previous feasibility and site selection studies have selected four broad sites on which Delta is proposing to undertake planning activities and obtain relevant approvals for ash placement. The four sites are, Lamberts North, Lamberts South, Neubecks Creek and Ivanhoe No 4. The location of each site is shown in **Figure 2-1.**

- **Figure 2-1 Location of Proposed Ash Disposal Facility**



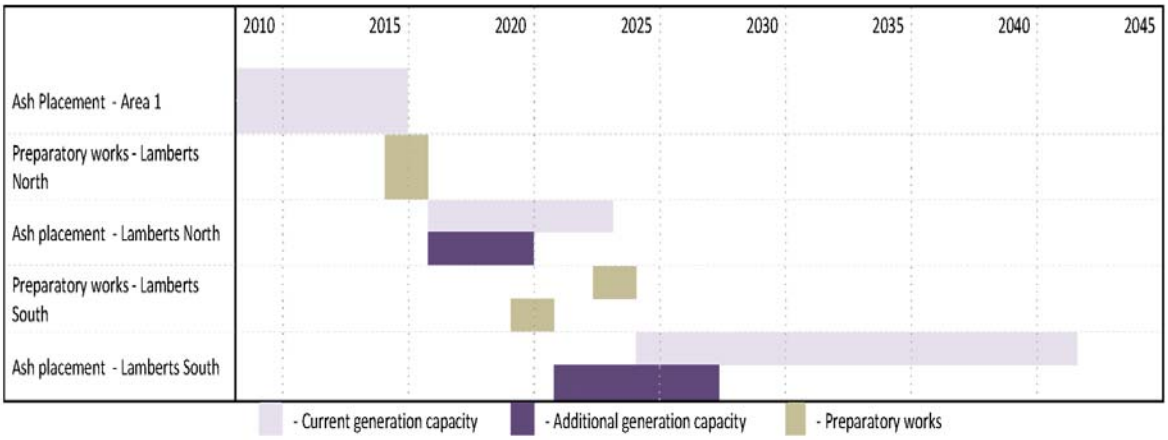
Lamberts North and Lamberts South are currently being mined for coal and it is intended that the development of the Lamberts North and Lamberts South areas would occur within the next few years. The staging for ash placement would include the completion of Area 1 and preparation works for Lamberts North followed by the progressive filling of Lamberts North. Nearing completion of Lamberts North, preparation and then filling of Lamberts South would commence. Approximately 786,000 m^3 of ash would be placed annually.

Concept approval is also being sought for additional ash disposal sites at Neubecks Creek and Ivanhoe No 4. These areas would most likely be considered for ash placement if the Mt Piper Extension project were to proceed as a coal fired plant. If Mt Piper Extension proceeds as a coal fired plant, the annual volume of ash to be placed would be about 2,100,000 m^3.

The proposed strategy for Lamberts North and Lamberts South is broken up into four stages, as shown in **Figure 2-2**.

The proposed location of the new ash placement facility is closer to nearby residents thus having potential for a greater impact on sensitive receivers. Additionally vehicles carrying ash from the conveyor to the emplacement facility would be required to travel a greater distance on unpaved roads resulting in a possible increase in dust emissions.

- **Figure 2-2 Proposed Placement Strategy for Lamberts North and Lamberts South**



3. Assessment Criteria

The DECCW has set criteria to assess the air quality impacts of existing or proposed facilities. These criteria are outlined in the DECCW's *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005).

Of particular relevance to the proposed activities are criteria for particulate matter. There are various classifications of particulate matter, with the DECCW providing assessment criteria for the following:

- Total suspended particulates (TSP);
- Particulate matter with equivalent aerodynamic diameter less than or equal to 10 microns (PM_{10}); and
- Deposited dust.

Table 3-1 summarises the current air quality assessment criteria for particulate matter, as noted by the DECCW. In general, these criteria relate to the total burden of dust in the air and not just the dust from project-specific sources. Therefore, some consideration of background levels needs to be made when using these criteria to assess impacts. A discussion of background levels in the study area is provided in **Section 4.3**.

- **Table 3-1 DECCW assessment criteria for particulate matter**

Pollutant	Averaging time	Criterion	Application
TSP	Annual average	90 µg/m^3	Cumulative
PM_{10}	Annual average	30 µg/m^3	Cumulative
	Maximum 24-hour average	50 µg/m^3	Cumulative
Deposited dust	Annual average (maximum increase)	2 g/m^2/month	Cumulative
	Annual average (maximum total)	4 g/m^2/month	Cumulative

The DECCW's criteria for TSP and deposited dust have been set to protect against nuisance impacts, while the PM_{10} criteria have been set to protect against adverse health effects.

There is an increasing body of evidence to suggest that criteria for finer particulate matter (for example, $PM_{2.5}$) may be more important for protecting against adverse health impacts, however, at this stage the DECCW has not set criteria for $PM_{2.5}$ that are applied on a project-specific basis.

4. Existing Environment

4.1. Overview

The following sub-sections provide a summary of local air quality and the meteorological characteristics that influence atmospheric dispersion around Mt Piper.

4.2. Meteorological Data

Delta operates a meteorological station at the Mt Piper Power Station site, approximately 2km north-northwest of the proposed Lamberts South ash disposal area (refer **Figure 2-1**). The site records hourly wind speed, wind direction, temperature, pressure, relative humidity and solar radiation. Data collected for 2001 have been used in this assessment. Atmospheric stability and mixing height data, required for the dispersion model, have been generated by the CALMET meteorological processor. The approach for applying CALMET to the study area is fully described in the Mt Piper Power Station Extension Air Quality Assessment (SKM, 2009), with **Table 4-1** summarising the meteorological parameters.

Table 4-1 Summary of CALMET meteorological parameters

CALMET (v 6.326)	
Meteorological grid domain	25 km x 25 km (50 x 50 x 10 grid dimensions)
Meteorological grid resolution	0.5 km
Surface meteorological stations	One site, using: - Wind speed and wind direction from Mt Piper Power Station - Ceiling height, temperature, relative humidity and pressure data generated for the power station site by the TAPM simulation. - Cloud cover data (total amount) from Bureau of Meteorology records for Katoomba. Seven observations per day interpolated to hourly.
Upper air meteorological station	Generated for Mt Piper Power Station by the TAPM simulation
Simulation length	8760 hours (Jan 2001 to Dec 2001)

4.2.1. Wind Speed and Wind Direction

Annual and seasonal wind roses from the wind data collected at the Mt Piper site are presented in **Figure 4-1**. On average the annual wind speed measured at the Mt Piper was 2.5 metres per second (m/s) and the predominant wind was from the west-southwest. Wind speed is at its highest during spring with an average of 2.7m/s, predominantly from the west-southwest, with winds from the southeast also commonly occurring. During the remainder of the year the dominant wind direction is from the west-southwest with average wind speeds of 2.6, 2.2 and 2.4m/s for summer, autumn and winter respectively.

Figure 4-1 Wind Roses for Mount Piper 2001

4.2.2. Atmospheric Stability

To use the wind data to assess dispersion, it is necessary to also have available data on atmospheric stability. In dispersion modelling, atmospheric stability describes the rate at which a plume will disperse, represented by typically six classes; A to F (that is, unstable through to very stable conditions).

For the Mt Piper site, a stability class was determined for each hour in the 2001 meteorological dataset using the CALMET meteorological model with cloud and upper air data. **Table 4-2** shows the frequency of occurrence of the stability categories expected in the area.

- **Table 4-2 Frequency of occurrence of stability categories in the area**

Stability class	Frequency of occurrence (Mt Piper, 2001) (%)
A	0.9
B	6.3
C	14.8
D	42.2
E	5.6
F	30.1
Total	100

The most common stability class was determined to be D class. This suggests that the dispersion conditions are such that dust emissions will disperse rapidly for a significant proportion of the time.

4.2.3. Climate

The Bureau of Meteorology collects climatic information from Lithgow, to the east of the study area, and a range of meteorological data collected from this station is presented in **Table 4-3** (BOM, 2009).

Temperature and humidity data consist of monthly averages of 9 am and 3 pm readings. Also presented are monthly averages of maximum and minimum temperatures. Rainfall data consist of mean monthly rainfall and the average number of rain days per month.

- **Table 4-3 Climatic information for Lithgow**

Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean maximum temperature (C)	26	25	22	18	14	11	10	12	15	19	22	25
Mean minimum temperature (C)	12	12	10	7	4	2	1	1	3	6	8	10
Mean rainfall (mm)	94	84	84	63	63	67	68	63	59	68	70	76
Highest rainfall (mm)	242	330	339	295	336	242	350	374	196	233	187	236
Lowest rainfall (mm)	5	0	7	2	3	9	3	2	7	3	2	0
Mean number of days of rain	11	10	11	9	10	12	12	11	10	10	10	10
Mean number of clear days	7	5	7	8	7	6	8	10	9	7	7	8
Mean number of cloudy days	12	12	12	10	13	14	12	11	10	11	11	10
Mean 9am temperature (C)	19	18	16	12	9	6	5	6	10	14	16	18
Mean 9am relative humidity (%)	64	70	73	76	81	82	79	73	64	60	60	61
Mean 9am wind speed (km/h)	7	6	7	8	7	8	8	10	11	10	9	8
Mean 3pm temperature (C)	24	23	21	17	13	10	9	11	14	17	20	23
Mean 3pm relative humidity (%)	54	58	60	59	66	67	66	56	54	51	53	50
Mean 3pm wind speed (km/h)	10	9	9	9	10	11	11	13	13	12	11	11

Monthly climate statistics for Lithgow (Birdwood Street), station number 063224. Commenced: 1889; Last record: 2006; Latitude (deg S): -33.49; Longitude (deg E): 150.15; Elevation: 950 m; State: NSW. Source: Bureau of Meteorology, 2009.

The data from **Table 4-3** show that the area is characterised by mild to warm summers and cold winters. January is typically the warmest month with a mean daily maximum temperature of 26°C. July is the coolest month with a mean daily minimum temperature of 10°C. In summer, the average maximum temperature ranges from 25 to 26°C and the minimum temperature ranges from 10 to 12°C. In winter, the average maximum temperature ranges from 10 to 12°C and the minimum temperature ranges from 1 to 2°C.

Rainfall data collected at Lithgow show that January is usually the wettest month with mean rainfall of 94 mm, falling over an average of 11 days in the month. The lowest monthly rainfall on average is September, with a mean monthly rainfall of 59 mm over 10 raindays. The mean annual rainfall is 858 mm with an average of 126 raindays each year.

4.3. Existing Air Quality

The existing air quality around the project area has the potential to be influenced by many sources, including local construction and agricultural activities, vehicles on unsealed roads, operations at Mt Piper Power Station, the nearby Wallerawang Power Station and the existing coal mining operations. Particulate emissions are currently controlled at MPPS by highly efficient fabric filter baghouses with dust effectively controlled through compaction and treatment processes. Delta's current air emission limits are identified by EPL 13007.

Potential dust sources from the Lambert's Gully operations include unsealed traffic areas, coal stockpiles and blasting. Dust is controlled on unsealed traffic areas by the use of water carts.

The DECCW operates air quality monitoring stations in many locations of NSW, including some regional areas. The closest monitoring site to the Project area is at Bathurst (approximately 45 km to the west of the site). The Bathurst air quality monitoring station currently records Ozone (O_3) and PM_{10} (using a tapered element oscillating microbalance). **Table 4-4** shows the monthly PM_{10} data recorded at Bathurst during 2007.

- **Table 4-4 Monthly Particulate Matter Concentrations at Bathurst (2007)**

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum 24-hour PM_{10} Concentration (µg/m^3)	66	37	25	40	47	14	21	20	31	164	21	21
Monthly Average PM_{10} Concentration (µg/m^3)	24	17	15	20	14	9	9	12	17	28	13	12

In 2007, two exceedences of the DECCW 24-hour criteria (50µg/m^3) occurred (refer to **Table 4-4**). The first exceedance, 66µg/m^3 in January, was likely to be attributed to strong winds (over 90 km/h) in the area (BOM, 2007). The second exceedance of 164µg/m^3 occurred in October, and was likely to be attributed to bushfires which occurred just east of Bathurst in the Eusdale Nature reserve during the month (ABC, 2007). The maximum 24-hour PM_{10} concentrations during April and May were also slightly elevated with maximum concentration of 40 and 47µg/m^3 respectively. The average annual PM_{10} concentration was 16µg/m^3 which is well below the DECCW criterion of 30µg/m^3. In the absence of existing annual TSP concentration data it has been assumed that the annual TSP concentration would be double the annual PM_{10} concentration. This equated to an annual TSP concentration of 32µg/m^3, which is below the DECCW criterion of 90µg/m^3. It should be noted that assumptions on existing background levels would take into account current ash emplacement activities undertaken within Area 1 (refer to **Figure 2-1**). Deposited dust is recorded near Wallerawang Power Station, using dust deposition gauges. The closest dust deposition gauge

(No. DG5), located approximately 4km south east of the proposed works, recorded an annual average dust deposition of 1.2g/m^2/month in 2005 (HAS 2008).

The discussion quality above, has led to the following conclusions about the existing air quality environment at residential locations:

- Annual average PM_{10} and TSP concentrations are in compliance with the DECCW's air quality assessment criteria;
- Short-term (that is, 24-hour average) PM_{10} concentrations are highly variable and are likely to have exceeded the 50 µg/m^3 criterion on occasions; and
- Average dust deposition levels are in compliance with the DECCW's air quality assessment criteria.

For this assessment the following background levels have been assumed to apply at the nearest sensitive receptors:

- Annual average TSP of 32µg/m^3;
- Annual average PM_{10} of 16µg/m^3; and
- Annual average dust deposition of 1.2g/m^2/month.

5. Estimated Dust Emissions

Proposed ash handling activities have been combined with emissions factors developed both locally and by the US EPA to determine total dust emissions. The emission factors used for this assessment have been drawn largely from the following:

- *Emission Estimation Technique Manual for Mining* (NPI, 2001); and
- AP 42 (US EPA, 1985 and updates).

The following emission factor equations discussed in this section relate to:

- The quantity of TSP generated by a particular operation to the type of operation;
- Intensity of the operation (e.g. the quantity of material handled per unit of time); and
- The properties of the materials being handled (e.g. silt content and moisture level).

Sources of dust on the site would include:

- Loading and unloading ash including:
  - Loading ash to trucks;
  - Emplacement of ash into the repository;
- Vehicles hauling ash to emplace from conveyor while travelling on unpaved areas;
- Shaping the emplaced ash using dozers;
- Wind erosion from the emplacement of ash; and
- Emplacement of topsoil on top of the ash.

It has been assumed that onsite operations would only occur between the hours of 6am and 8pm.

A discussion of the emission factors and operational data used for this assessment is included in **Appendix A**. A summary of estimated annual TSP emissions, including the proposed Mt Piper Extension option is shown in **Table 5-1**.

Table 5-1 Summary of Dust Emissions

ACTIVITY	Estimated annual TSP emissions (kg/y)	
	Proposed Placement Area (with existing MPPS operations)	Proposed Placement Area (with Mt Piper Extension)
Loading ash to trucks	80	220
Emplacement of ash into the repository	80	220
Vehicles carrying ash on unpaved roads	166,000	443,520
Shaping the emplaced ash using dozers	4,000	4,000
Wind erosion from the emplacement of ash	182,630	182,630
Emplacement of topsoil on top of the ash	400	1070
TOTAL	**353,200**	**631,660**

All numbers are rounded to the nearest 10

It should be noted that the above TSP emissions have been calculated without dust emission control measures and as such may be considered worst case as noted in **Section 7.2**.

6. Assessment Methodology

6.1. Overview

This section describes the assessment methodology for dispersion modelling of the Lamberts North and Lamberts South sites. Specifically this involves a Level 2 air quality assessment conducted in accordance with the "*Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW"* (DEC, 2005). The Level 2 assessment uses site-specific input data, such as detailed meteorological information.

6.2. Dispersion Model

The AUSPLUME (version 6.0) model was used to predict dust concentrations within the vicinity of the proposed placement area. AUSPLUME was developed by the Victorian EPA, and is an approved model for conducting site-specific air quality assessments in NSW (DEC, 2005).

Inputs required by the AUPLUME model include:

- Emission source locations;
- Emission rates;
- Topographical data;
- Locations of sensitive receptors; and
- Meteorological conditions.

The dispersion modelling was based on meteorological information and the dust emission estimates to predict dust concentrations and deposition levels in the vicinity of the Project.

6.3. Dust Sources

Operations were represented by a series of volume sources located according to the location of activities for each modelled scenario. **Figure 6-1** shows the location of the modelled sources, where each the emissions from the dust generating activities were assigned to one or more of these source locations.

The volume sources were given TSP emission rates and duplicated into three source groups, representing three particle size categories; namely, $PM_{2.5}$ (particles in size range 0 to 2.5 µm), $PM_{2.5-10}$ (particles in size range 2.5 to 10 µm) and PM_{10-30} (particles in size range 10 to 30 µm). Each source was assumed to have an aerodynamic particle diameter equal to the geometric mean of the limits of the particle size range, except for the $PM_{2.5}$ group, which was assumed to have a particle size of 1 µm.

Once the model had completed each simulation, the three output files from each source group were combined according to the distribution of particles in each particle size range. The distribution of particles in each size range has been derived from measurements published by the State Pollution Control Commission (**SPCC, 1986**) and is as follows:

- $PM_{2.5}$ is 4.7% of TSP;
- $PM_{2.5-10}$ is 34.4% of TSP; and
- PM_{10-30} is 60.9% of TSP.

Emissions from each source were developed on an hourly time step, taking into account the level of activity at that location and the hourly wind speed. This approach ensured that light winds corresponded with lower dust generation and higher winds, with higher dust generation.

Emissions from all activities have been modelled between the hours of 6 am and 8 pm, except for wind erosion sources which were modelled for 24 hours per day.

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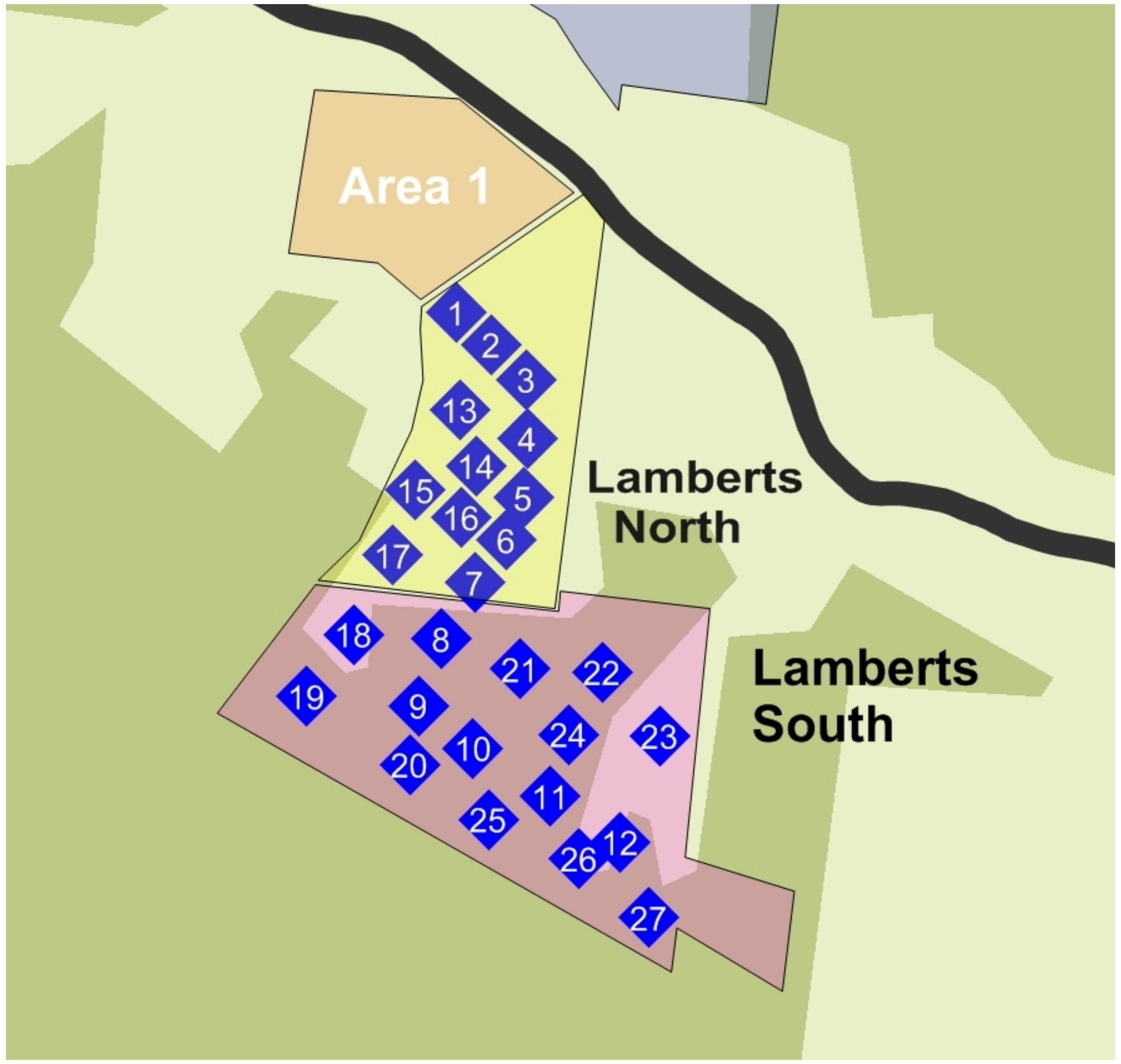
- **Figure 6-1 Source Locations and Activity Type**



Source No.	Activity					
	Loading ash to trucks	Hauling to emplace from conveyor	Unloading ash from trucks	Dozers shaping ash placement areas	Loading topsoil to ahs placement areas	Wind erosion from exposed ash placement areas
1	✓	✓				
2		✓				
3		✓				
4		✓			✓	
5		✓			✓	
6		✓			✓	
7		✓			✓	
8		✓	✓	✓		✓
9		✓	✓	✓		✓
10		✓	✓	✓		✓
11		✓	✓	✓		✓
12		✓	✓	✓		✓
13					✓	
14					✓	
15					✓	
16					✓	
17					✓	
18			✓	✓		✓
19			✓	✓		✓
20			✓	✓		✓
21			✓	✓		✓
22			✓	✓		✓
23			✓	✓		✓
24			✓	✓		✓
25			✓	✓		✓
26			✓	✓		✓
27			✓	✓		✓

6.4. Sensitive Receptors

The term sensitive receptor refers to all nearby receptors that may potentially be affected by dust emissions, both now and in the future. Land uses surrounding the study site is predominantly rural, with some residential properties lying to the east and south of the site. The location of sensitive receivers is shown in **Figure 2-1** and is summarised in **Table 6-1**.

- **Table 6-1 Location of Sensitive Receptors**

ID No.	Address	Lot and DP No
1	Noon Street, Blackmans Flat	Lot 19 DP14100
2	Castlereagh Highway, Blackmans Flat	Lot 8 DP14100
3	Castlereagh Highway, Blackmans Flat	Lot 1 DP 337105
4	View Street, Black Blackmans Flat	Lot 1 DP125087
5	Castlereagh Highway, Blackmans Flat	Lot 1 DP 953671
6	Castlereagh Highway, Lidsdale	Lot 252 DP 751651
7	Ian Holt Drive, Lidsdale	Lot 101 DP1096754
8	Castlereagh Highway, Wallerawang	Lot 371 DP 751651
9	Ian Holt Drive, Lidsdale	Lot 9 DP1088207
10	Commercial Hotel, Main Street, Wallerawang	Lot A DP 369388
11	Main Street, Portland	Lot 14 DP 758855
12	Portland Road, Wallerawang	Lot 172 DP 751651
13	Pipers Flat Road, Wallerawang	Lot 185 DP751651

6.5. Modelling Scenarios

A worst case scenario was assumed in which vehicles would be required to travel from the conveyor to the south eastern end of Lambert South for emplacement of ash (Stage 4). It is assumed that Lamberts South (Stage 3) would be capped with topsoil at the time of commissioning for Lamberts south for ash placement.

The following two scenarios were modelled:

- Proposed ash placement site (786,500m^3/y);
- Proposed ash placement site plus the proposed Mt Piper Extension (2,100,000m^3/y).

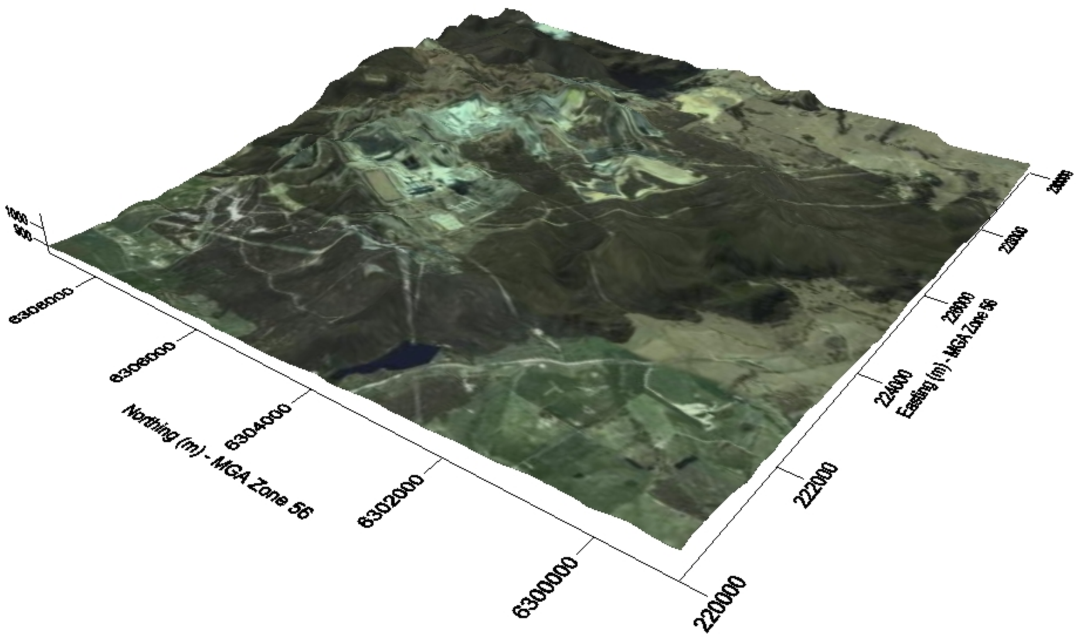
6.6. Emissions

Table 5-1 provides a summary of the emissions from each source. Emission factors incorporated into the dispersion model are discussed in detail in **Appendix A**.

6.7. Terrain

The proposed site is located amongst undulating terrain at elevations ranging between approximately 300 and 1,300 metres (refer to **Figure 6-2**). Ground-level dust emissions have been predicted over an area of 10 km by 10 km with grid receptors located at located at 500 m spacings. An additional 179 discrete receptors on or within close proximity to the site were added to the model to increase resolution near the emission sources.

- **Figure 6-2 Terrain in the study region**



6.8. Meteorological Data

Data collected in a one year period from the Mt Piper Meteorological Station for 2001 was used in the dispersion modelling. The data were formatted for use in the AUSPLUME model and are described in **Section 4.2**, with wind roses provided in **Figure 4-1**. There were 8,736 hours available in the dataset which represented 99.7% of the year.

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7. Assessment of Impacts

7.1. Overview

This section of the report provides a quantitative assessment of the dust impacts associated with the proposed Lamberts North and Lamberts South ash placement areas and a qualitative assessment of dust impacts for further staging of the proposed Ivanhoe No. 4 and Neubecks Creek sites.

As per the DGRs, this section also provides an assessment of the potential odour impacts, ash contaminants at the Lamberts North and Lamberts South sites and a cumulative impacts assessment.

7.2. Predicted Impacts from Project

This section outlines the results of modelling using AUSPLUME.

7.2.1. Total Suspended Particulates

Predicted annual average TSP concentrations are show that the annual 90µg/m^3 criterion contour does not extend beyond the site boundary for the proposed ash placement works.

Table 7-1 summarises the model predictions at the nearest sensitive receptors. It can be seen from this table that all sensitive receivers are predicted to experience an incremental increase in the annual TSP concentration of less than 6µg/m^3, with the highest TSP concentration (5.3µg/m^3) occurring at sensitive receptor one (1). These results are well below DECCW criterion of 90µg/m^3, even when added to the assumed annual average background TSP concentration of 32µg/m^3. The model predictions suggest that there will be no adverse impacts, in terms of TSP concentrations, on nearest sensitive receivers.

- **Table 7-1 Predicted Annual Average TSP Concentrations**

Sensitive Receptor	Predicted TSP increment (µg/m^3)	Assumed background (µg/m^3)	Total TSP (µg/m^3)	Criterion (µg/m^3)
1	5.3	32	37.3	90
2	4.5	32	36.5	90
3	2.0	32	34.0	90
4	1.8	32	33.8	90
5	1.7	32	33.7	90
6	1.2	32	33.2	90
7	1.1	32	33.1	90
8	2.1	32	34.1	90
9	0.5	32	32.5	90

Sensitive Receptor	Predicted TSP increment (μg/m^3)	Assumed background (μg/m^3)	Total TSP (μg/m^3)	Criterion (μg/m^3)
10	0.4	32	32.4	90
11	0.2	32	32.2	90
12	1.1	32	33.1	90
13	0.5	32	32.5	90

7.2.2. Particulate Matter (PM_{10})

Predicted maximum 24-hour average concentrations at the nearest sensitive receivers are summarised in **Table 7-2**.

The results show that the 50μg/m^3 criterion contour (as indicated in purple) may extend beyond the site boundary for the proposed expansion at Lamberts North and Lamberts South. Sensitive receiver 1 is predicted to experience the highest maximum 24-hour average concentration of 15.6μg/m^3.

The measurement data (refer **Section 4.3**) have shown that background PM_{10} concentrations are highly variable and it is likely that the DECCW's 50 μg/m^3 criterion is exceeded in the region on a number of occasions each year. For assessment of cumulative 24-hour average PM_{10} concentrations, the approach of adding maximum measured to maximum predicted would not demonstrate compliance with the 50 μg/m^3 criterion. This is because the historical maximum measured values (over 100 μg/m^3) would not permit any project contribution before 50 μg/m^3 is exceeded.

Existing PM_{10} concentrations vary from day to day but if it were assumed that the existing annual average PM_{10} concentration (16 μg/m^3) occurred every day of the year then the assessment would be very much simplified as a maximum project contribution of 34 μg/m^3 or more would be the point at which potential air quality impacts would be observed - assuming 50 μg/m^3 is the level at which potential impacts occur. No sensitive receivers are predicted to exceed 34 μg/m^3.

Clearly, the probability of the project causing an exceedance of 50 μg/m^3 increases, with increasing background levels. It should also be emphasised that the model results present the predicted "worst-day" in the year at each location, in terms of potential impacts from the Project.

Table 7-2 Predicted Maximum 24-hour Average PM_{10} Concentrations

Sensitive Receptor	Predicted PM_{10} increment ($\mu g/m^3$)	Assumed background – average ($\mu g/m^3$)	Criterion ($\mu g/m^3$)
1	15.6	Variable	50
2	14.1	Variable	50
3	9.6	Variable	50
4	9.0	Variable	50
5	8.6	Variable	50
6	6.2	Variable	50
7	6.6	Variable	50
8	14.7	Variable	50
9	4.8	Variable	50
10	3.7	Variable	50
11	1.9	Variable	50
12	8.7	Variable	50
13	4.4	Variable	50

Predicted annual average PM_{10} concentrations indicate that the 30$\mu g/m^3$ criterion contour slightly exceeds the Lamberts North boundary. All sensitive receivers are predicted to experience an annual PM_{10} concentration of less than 30$\mu g/m^3$ (refer to **Table 7-3**) with the highest incremental increase predicted to be 4.5 $\mu g/m^3$ at sensitive receiver 1. These results demonstrate compliance with the DECCW's criterion of 30$\mu g/m^3$, even when assumed background concentrations of 16$\mu g/m^3$ are added to the predictions.

Table 7-3 Predicted Annual Average PM_{10} Concentrations

Sensitive Receptor	Predicted PM_{10} increment ($\mu g/m^3$)	Assumed background ($\mu g/m^3$)	Total PM_{10} ($\mu g/m^3$)	Criterion ($\mu g/m^3$)
1	4.5	16	20.5	30
2	3.8	16	19.8	30
3	1.7	16	17.7	30
4	1.5	16	17.5	30
5	1.4	16	17.4	30
6	1.0	16	17.0	30
7	1.0	16	17.0	30
8	1.7	16	17.7	30
9	0.4	16	16.4	30
10	0.3	16	16.3	30
11	0.1	16	16.1	30

Sensitive Receptor	Predicted PM_{10} increment (µg/m^3)	Assumed background (µg/m^3)	Total PM_{10} (µg/m^3)	Criterion (µg/m^3)
12	0.9	16	16.9	30
13	0.4	16	16.4	30

For the purpose of this assessment a worst case scenario has been assumed in which no controls have been put in place to reduce onsite dust emissions. It is noted that existing dust control measures used in Area 1 such as application of sprays and molasses to exposed surfaces within the placement area and use of water trucks on unpaved haul roads would also be applied to the proposed expansion areas. Therefore, it is likely that the maximum 24-hour and annual PM_{10} concentrations would be lower than predicted.

Further, the assessment has not removed any existing contribution from current ash emplacement activities within Area 1, and thus cumulative impacts discussed in this assessment are likely to be lower than predicted.

7.2.3. Deposited Dust

Predicted annual average dust deposition results are summarised in **Table 7-4**.

The results indicate that the 2g/m^2/month contour (maximum increase) extends slightly beyond the site boundary, east of Lamberts North and Lamberts South, however it can be seen that all sensitive receivers are predicted to experience less 2g/m^2/month of deposited dust due to the proposal (refer to **Table 7-4**).

The 4g/m^2/month (maximum total) criterion contour would slightly exceed the site boundary. When the assumed background concentration of 1.2g/m^2/month is added to the predicted concentration at the sensitive receivers it can be seen that all sensitive receivers experience a deposited dust concentration well below the 4g/m^2/month (maximum total).

These model predictions suggest that there will be no adverse impacts on sensitive receivers, in terms of dust deposition.

▪ **Table 7-4 Predicted annual average dust deposition**

Sensitive Receptor	Predicted Deposited Dust increment (g/m^2/month)	Maximum Increase Criterion (g/m^2/month)	Assumed background (g/m^2/month)	Total Predicted Deposited Dust (g/m^2/month)	Maximum Total Criterion (g/m^2/month)
1	0.4	2	1.2	1.6	4
2	0.4	2	1.2	1.6	4

Sensitive Receptor	Predicted Deposited Dust increment (g/m^2/month)	Maximum Increase Criterion (g/m^2/month)	Assumed background (g/m^2/month)	Total Predicted Deposited Dust (g/m^2/month)	Maximum Total Criterion (g/m^2/month)
3	0.2	2	1.2	1.4	4
4	0.2	2	1.2	1.4	4
5	0.2	2	1.2	1.4	4
6	0.1	2	1.2	1.3	4
7	0.1	2	1.2	1.3	4
8	0.2	2	1.2	1.4	4
9	0.0	2	1.2	1.2	4
10	0.0	2	1.2	1.2	4
11	0.0	2	1.2	1.2	4
12	0.1	2	1.2	1.3	4
13	0.0	2	1.2	1.2	4

7.3. Predicted Impacts from Project plus Mt Piper Extension

Should project approval be awarded to develop a new 2,000 MW coal-fired plant this would result in the generation of an additional 1,314,000 m^3 of ash, requiring placement at the proposed ash placement. Cumulative impacts of on residences during the operation of the proposed ash placement site and the possible new coal-fired plant are assessed in this section.

Predicted dust concentrations and deposition levels due to ash placement from Mt Piper Extension are included in **Appendix B**. These results show slightly higher impacts than for the Mt Piper 1and 2 only scenario (due to the higher ash volume quantified above) and the annual average PM_{10}, TSP and dust deposition levels are unlikely to be exceeded. Again, the maximum 24-hour average PM_{10} concentrations are below the criterion (50 µg/m^3), although it is noted that the possibility of the project causing an exceedance of the criterion increases with increasing background levels.

As discussed in the previous section for the purpose of this assessment a worst case scenario has been assumed in which no controls have been put in place to reduce onsite dust emissions. It is assumed that existing dust control measures used in Area 1 would also be applied to the proposed ash placement areas. When taking into account the use of dust control measures and that the assumed background concentration would include the existing operational activities undertaken within Area 1, it is likely that the maximum 24-hour and annual PM_{10} concentrations would be lower than predicted.

7.4. Construction Impacts

Preparation of the proposed Mt Piper Ash Placement areas may require bulk earthworks which have the potential to result in nuisance dust emissions. Dust emissions would arise primarily from the following activities:

- Clearing of vegetation and topsoil;
- Loading of material to and from trucks and travelling over unsealed roads; and
- Wind erosion from unsealed surfaces and stockpiles.

Appropriate safeguards would be required to minimise potential air quality impacts during construction including watering of exposed soils when necessary, particularly during dry and windy conditions, stabilising work areas and minimising areas of surface disturbance.

7.5. Ivanhoe No. 4 and Neubecks Creek Sites

Placement of ash at the proposed Ivanhoe No. 4 and Neubecks Creek sites, have the potential to generate dust if not managed properly. These areas may require further assessment in accordance with the DECC *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in* NSW, in the project approval stage. A qualitative assessment has been undertaken in the current study which identifies the key dust-generating sources and suitable measures to minimise emissions.

Ash within the placement area can be exposed for a considerable time before capping, which can lead to the generation of dust emissions particularly during dry and windy conditions. Number activities associated with the emplacement of ash would also generate ash emissions including:

- Loading and unloading ash including:
  - Loading ash to trucks;
  - Emplacement of ash into the repository;
- Vehicles hauling ash to emplacement from conveyor while travelling on unpaved areas; and
- Shaping the emplaced ash using dozers.

It is assumed that the same dust control methods currently used within the existing Area 1 would be applied to the proposed sites including:

- Conditioning of fly ash with water or brine, ensuring that the moisture content sits at approximately 15%;
- Application of sprays to wet the ash surface and prevent dusting, with any runoff from the ash placement area is contained within onsite ponds;
- Application of molasses in areas of exposed ash, where application of sprays is not practical; and

- Use of water trucks on unpaved haul roads.

In accordance with the proposed placement strategy (refer to **Figure 2-2**), once the capacity is reached for a placement area, it would be capped. Emplacement of topsoil used for capping would also result in dust emissions from wind erosion and vehicle activities. Once an area is capped it would be re-vegetated, thereby avoiding the any further risk of dust generation.

7.6. Cumulative Impacts with Other Projects

In addition to the proposed Mt Piper Extension Delta has obtained approval to extend the existing Kerosene Vale ash storage area (approximately 4km southeast of the study area) to enable storage of ash from Wallerawang Power Station. Predicted TSP, PM_{10} and deposited dust emissions for the Kerosene Vale project is set out in an air quality assessment prepared by Holmes Air Sciences (HAS 2008). The predicted cumulative TSP, PM_{10} and deposited dust levels from the Holmes Air Sciences assessment are provided in **Table 7-5**. These results add the predictions for the most affected sensitive receptor location due to Mt Piper (that is, Receiver 1) to the predictions for the most affected sensitive receptor location due to proposed Kerosene Vale activities. Maximum 24-hour average PM_{10} concentrations are not included as the maximum impacts from the Mt Piper ash placement area (**Section 7.2.2**) will not occur at the same time as maximum impacts from the Kerosene Vale ash area.

- **Table 7-5 Potential cumulative impacts with Kerosene Vale Ash Project**

Pollutant	Proposed Mt Piper Ash Placement (with existing operations) (786,500m^2)*	Mt Piper Ash Placement (with Mt Piper Ext) (2,100,000m^2)*	Kerosene Vale Ash Repository (HAS, 2008)	Maximum cumulative Impact
Annual PM_{10} (µg/m^3)	20.5	25.9	3	28.9
Annual TSP(µg/m^3)	37.3	43.4	4	47.4
Deposited Dust (g/m^2/month)	1.6	1.9	0.5	2.4

*Includes assumed background concentrations (refer to **Section 4.3**)

In **Table 7-5** it can be seen that the cumulative impact for annual TSP and PM_{10} of the Mt Piper Extension (and associated ash placement site) and the Kerosene Vale ash storage area extension do not exceed the DECCW criteria of 90 and 30µg/m^3 respectively. Predicted annual average deposited dust is also within the DECCW criterion of 4g/m^2/month. It follows that the cumulative impacts of the Project will be at acceptable levels.

It has been assumed that existing dust control measures used in Area 1 would also be applied to the proposed ash placement areas, and that existing background concentrations used in this assessment include ash emplacement activities within Area 1 has resulted in an over prediction of cumulative impacts. Therefore, PM_{10} and TSP levels are likely to be lower than predicted.

7.7. Odour Impacts

The fly ash produced from the burning of pulverised coal in a coal-fired boiler is a fine-grained, powdery particulate material that is generally odourless. Odour problems associated with fly ash generally only occur when ammonia-based NO_x (oxides of nitrogen) reduction systems are used at the power station. Such ammonia based NO_x reduction systems convert flue gas NO_x into elemental nitrogen through both high temperature use of ammonia (selective non-catalytic reduction [SNCR]) and the use of ammonia with a catalyst (selective catalytic reduction). Both these processes can result in deposition of ammonia on fly ash, and as a result detectable odours may be experienced from the fly ash (Lamar Larrimore 2002).

Given that a NH_3 based NO_x reduction system is currently not used at MPPS, and that no odour issues have arisen within the current ash placement area it is unlikely that the proposed ash placement activities will cause odour impacts.

7.8. Ash Contaminants

Trace elements found within the ash, both naturally and due to the conditioning of ash with brine include (CW 2007):

- Arsenic (As);
- Silver (Ag);
- Barium (Ba)
- Beryllium (Be)
- Boron (B);
- Cadmium (Cd)
- Chromium (Cr);
- Copper (Cu);
- F (Fluorine);
- Iron (Fe);
- Mercury (Hg);
- Manganese (Mn);
- Magnesium (Mg);
- Calcium (Ca);
- Molybdenum (Mo);
- Potassium (K)
- Dioxins; and
- Polycyclic Aromatic Hydrocarbons (PAH)

Higher concentrations of these trace elements are likely to be found when the brine is co-placed with ash. Currently the use of ash conditioning is intermittent and occurs only when the ash is to be directed to an approved co-placement area and when conditions for the use of brine are favourable. The *Statement of Environmental Effects, Mt Piper Power Station, and Proposed Extension of the Brine in Ash Co-Placement Area* (CW 2007) compares the concentration of the above contaminants in the brine to the NSW EPA (1999) guidelines for management of liquid wastes.

Fluoride and nickel concentrations were found to slightly exceed these guidelines. However given that co-placement of the brine with ash is intermittent and occurs only when conditions for the use of brine are favourable dust emissions from the emplacement of ash are unlikely to contain high enough concentrations of these contaminants to cause exceedances of air quality criteria at all ground level locations.

8. Conclusion

This report provides an assessment of potential dust, odour and ash contaminants associated with the proposed Mt Piper Ash Placement Project. Computer-based dust dispersion modelling was undertaken for the Lamberts North and Lamberts South ash areas and used to assess the impacts of the proposal. A qualitative assessment was undertaken for odour and ash contaminants, and for the proposed Ivanhoe No. 4 and Neubecks Creek sites was undertaken.

Meteorological data from the Mt Piper Power Station site was combined with estimated dust emissions from proposed activities to predict off-site TSP, PM_{10} and deposited dust levels.

An additional scenario was also developed which took into account of ash requiring placement from the proposed Mt Piper Extension Project.

The results from the assessment indicated that The Project is unlikely to cause exceedances of annual PM_{10}, TSP and dust deposition criteria at the nearest sensitive receptor locations. There is potential for the maximum 24-hour average PM_{10} criteria to be exceeded from time to time although it is unlikely that the Project will be the cause of such exceedances. It was noted that the probability of the Project causing an exceedance of 50 $\mu g/m^3$ increases, with increasing background levels but since the maximum 24-hour average model results represented the “worst-day” at each location in terms of potential impacts from the Project, the probability of maximum Project impacts occurring at the same time as those extreme events (such as bushfires) which lead to maximum background levels would be low.

The assessment was based on a worst case scenario, in which no controls have been put in place to reduce onsite dust emissions. It has been assumed that existing dust control measures used in Area 1, such as application of sprays and molasses to exposed surfaces and water trucks on unpaved haul roads, would also be applied to the proposed expansion areas. Consequently, dust concentrations and deposition levels should be lower than predicted. Background levels are also likely to be lower as current figures used in this report include ash placement operations currently undertaken at Area 1, which will no longer occur once Lamberts North is operational.

Assessment of the Ivanhoe No. 4 and Neubecks Creek found that ash placement at these sites would have the potential to generate dust and would require further detailed assessment in accordance with the DECC *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in* NSW, should project approvals be sought to use these areas for ash placement.

Finally, the Project emissions are unlikely to cause exceedances of air quality criteria for ash contaminant and odour at all ground-level locations.

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Appendix A Emission Calculations

Vehicles Carrying Ash on Unpaved Roads

For the purpose of this assessment a worst case scenario is adopted in which vehicles would be required to travel from the conveyor to the south eastern end of Lambert South for emplacement of ash, a total return distance of approximately 4.4km. It was assumed that 943,200 tonnes of ash per year would be transported to the Lamberts South site in 25t loads. An emission factor from unsealed roads of 1kg of dust for each vehicle kilometre travelled (VKT) should be achievable. The total quantity of dust generated per year from vehicle movements is calculated at 166,003kg.

Shaping the Emplaced Ash Using Dozers

Emissions from dozers on ash have been calculated using the following equation (NPI, 2001):

$$E_{TSP} = 2.6*(s^{1.2}/M^{1.3}) \qquad \text{kg/hour}$$

Where:

s = *Silt content (10%)*

M = *Moisture content (15%)*

Assuming that the silt content of the ash is 10% and that the ash moisture content is maintained at 15% during operational hours, the estimated emission factor for annual emissions would be 1.2kg/h. Assuming that the dozer operates 9 hours per day, the estimated emissions from dozers would be 4,005kg/y.

Wind Erosion from the Emplacement of Ash

The emission factor for wind erosion is given in the equation below (NPI, 2001):

$$E_{TSP} = 1.9*(s/1.5)*((365-p)/235)*(f/15) \text{ kg/ha/day}$$

Where:

s = *Silt content (10%)*

p = *Number of rain days per year (126)*

f = *Percentage of the time wind speed is above 5.4 m/s (4.8%)*

Assuming a silt content of 10%, 126 natural rain days (refer to **Section 4.2.3**) and the percentage of winds above 5.4m/s is 4.8% (from the Mt Piper Meteorological Station in 2001), the emission factor is 1489kg/ha/day. A worst case scenario is assumed in which the whole ash placement site for Lamberts South (123ha) would be susceptible to wind erosion. The total annual TSP emission is therefore 182,634kg/y.

Based on the current management procedures implemented at the Area 1 ash repository, the wind erosion emission estimates provide a conservative approach to assessing impact potential for further staged activities.

Emplacing of Topsoil

It was assumed that the topsoil used would be maintained at a moisture level of 1%. Once emplacement of the ash in a given area is completed, it would be capped with topsoil. For the purpose of this assessment it was assumed that Lamberts North would be capped with topsoil at the time of commissioning for Lamberts south for ash placement. The ash placement area would be capped with approximately 0.055 m^3 of topsoil for every tonne of ash emplaced. It was assumed that the topsoil would have a density of $2t/m^3$; the total mass of topsoil to be emplaced annually would be 103,752t/y.

The following equation (NPI, 2001) has been used to estimate the emissions from emplacement of topsoil:

$$E_{TSP} = k*0.0016*((U/2.2)^{1.3}/(M/2)^{1.4})$$

Where:

k = *0.74*

U = *wind speed (2.45m/s)*

M = *Moisture content (1%) [where* $0.25 \leq M \leq 4.8$*]*

Annual TSP emissions from emplacement of are estimated at 402t/y.

Since the same equipment is used for spreading topsoil as for spreading the ash no separate estimate of emissions has been estimated for the spreading of topsoil. It was assumed that this would be covered within the hourly allowance for the use of this equipment.

Emission Control Measures

A range of control measures to minimise or prevent the emission of dust from the current ash placement area (Area 1) are implemented onsite. Initially the fly ash is conditioned with water or brine such that the moisture content is approximately 15% which minimises the potential for dust generation at the placement site (CW 2007). In hot dry windy conditions, additional control measures are used including:

- Application of sprays to wet the ash surface and prevent dusting, with any runoff from the ash placement area is contained within onsite ponds;
- Application of molasses in some areas of exposed ash not subject to sprays to bind the surface and prevent dusting until further placement or capping occurs; and
- Use of water truck on unpaved haul roads.

Dust emission control measures have not been included in the emission estimates for the proposed activities.

Appendix B Project plus Mt Piper Extension

- **Table 8-1 Predicted Annual Average TSP Concentrations with Mt Piper Extension**

Sensitive Receptor	Predicted increment (µg/m^3)	Assumed background (µg/m^3)	Total (µg/m^3)	Criterion (µg/m^3)
1	11.4	32	43.4	90
2	9.3	32	41.3	90
3	4.1	32	36.1	90
4	3.6	32	35.6	90
5	3.3	32	35.3	90
6	2.4	32	34.4	90
7	2.3	32	34.3	90
8	4.3	32	36.3	90
9	1.0	32	33.0	90
10	0.8	32	32.8	90
11	0.3	32	32.3	90
12	2.4	32	34.4	90
13	1.1	32	33.1	90

- **Table 8-2 Predicted Maximum 24-hour average PM_{10} Concentrations with Mt Piper Extension**

Sensitive Receptor	Predicted increment (µg/m^3)	Assumed background (µg/m^3)	Criterion (µg/m^3)
1	36.4	Variable	50
2	30.4	Variable	50
3	18.4	Variable	50
4	18.0	Variable	50
5	17.4	Variable	50
6	13.2	Variable	50
7	15.8	Variable	50
8	36.1	Variable	50
9	12.3	Variable	50
10	8.7	Variable	50
11	4.3	Variable	50
12	21.1	Variable	50
13	10.7	Variable	50

Table 8-3 Predicted Annual Average PM_{10} Concentrations with Mt Piper Extension

Sensitive Receptor	Predicted increment (µg/m^3)	Assumed background (µg/m^3)	Total (µg/m^3)	Criterion (µg/m^3)
1	9.9	16	25.9	30
2	8.2	16	24.2	30
3	3.6	16	19.6	30
4	3.1	16	19.1	30
5	2.9	16	18.9	30
6	2.1	16	18.1	30
7	2.0	16	18.0	30
8	3.6	16	19.6	30
9	1.0	16	17.0	30
10	0.8	16	16.8	30
11	0.3	16	16.3	30
12	2.1	16	18.1	30
13	1.0	16	17.0	30

Table 8-4 Predicted Annual Average Dust Deposition with Mt Piper Extension

Sensitive Receptor	Predicted increment (g/m^2/month)	Assumed background (g/m^2/month)	Total (g/m^2/month)	Criterion (g/m^2/month)
1	0.7	1.2	1.9	4
2	0.6	1.2	1.8	4
3	0.3	1.2	1.5	4
4	0.3	1.2	1.5	4
5	0.3	1.2	1.5	4
6	0.2	1.2	1.4	4
7	0.2	1.2	1.4	4
8	0.3	1.2	1.5	4
9	0.0	1.2	1.2	4
10	0.0	1.2	1.2	4
11	0.0	1.2	1.2	4
12	0.1	1.2	1.3	4
13	0.0	1.2	1.2	4