Kerosene Vale Ash Repository Stage 2– Air Quality Review

April 2009 – March 2010

Prepared for

Delta Electricity

by

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SUMMARY

In 2002, Delta Electricity obtained approval for conversion of the wet slurry ash placement process at Wallerawang Power Station to dry ash. The dry ash repository was established at the Kerosene Vale open cut coal mine void site, on top of the original wet ash dam, Kerosene Vale Ash Dam (KVAD). When the KVAD was full of ash, wet ash placement was directed to the Sawyers Swamp Creek Ash Dam (SSCAD) from 1980, and ultimately the KVAD was capped with clay so dry ash placement could be undertaken.

The dry ash placement is called the Kerosene Vale Ash Repository (KVAR). Stage 1 of the placement was completed and capped in February 2009. Approval was obtained for further placement in the Stage 2 Area at the KVAR in November, 2008 with placement in the Stage 2 area commencing in April, 2009.

Stage 2 of KVAR (KVAR2) was subject to assessment under Part 3A of the Environmental Planning and Assessment Act 1979 and as required by the Approval Conditions, Delta Electricity prepared an Operation Environmental Management Plan (OEMP) prior to the commencement of KVAR2. The OEMP includes an Air Quality Management Plan, which includes monitoring and reporting requirements.

Malfroy Environmental Strategies Pty Ltd (M_E_S) has been engaged by Delta Electricity to review the air quality monitoring data collected during the first year of KVAR2 operations and to report on the results against the requirements of the OEMP.

Conclusions and recommendations arising from the review of the air quality monitoring data collected during the first year of KVAR2 operations appear below. In undertaking this data review some comments and observations are made on the operation of the air quality management plan.

1. The highest monthly dust deposition results in 2009 – 2010 were significantly influenced by huge regional dust events which swept across eastern Australia.

2. Care must be exercised in attempting to relate dust deposition results to potential dust sources. The contributing source, or sources, to an elevated result may be difficult to determine.

3. A number of gauges in the OEMP network are poorly located for the purpose of identifying impacts from KVAR2 and as such the OEMP dust gauge monitoring network should be reviewed.

4. The two, as yet to be installed, OEMP dust gauges in the residential area to the immediate west of KVAR2 will be of more relevance and use in identifying KVAR2 impacts than the more distant gauges, such as 27 and 28, and should be installed as soon as possible.

5. Consideration could be given to installing directional dust gauges, as well as standard dust gauges, to provide additional information regarding potential dust sources.

6. The dust gauge data from the first year of KVAR2 operations do not indicate that KVAR2 operations have resulted in dust deposition above the OEMP levels that trigger the requirement to implement additional control measures.

7. The OEMP requirement that: *If the 4 g/m^2/month limit is exceeded by more than 2 g/m^2/month a review of the effectiveness of the dust suppression regime and further mitigation measures shall be undertaken*, should be amended to require an assessment of the likely contribution of KVAR2 operations to the dust deposition levels prior to undertaking a review of the control measures.

8. No complaints regarding dust emissions from KVAR2 were received by either Delta Electricity or BBS during the first year of KVAR2 operations.

9. It is not possible with the data available to make any comment regarding the OEMP objective of *zero visible dust events in vicinity of KVAR2 operations*, although the camera installed at KVAR2 might be used in the future to assess performance against this objective.

10. Qualitative visual observations of collected dust samples provide support for the proposition that dust emissions from KVAR2 did not contribute adversely to measured deposition results in 2009 – 2010. Further support for this conclusion could be provided by the use of microscopic examination of a number of collected samples.

11. Interpretation of the dust gauge data might also be assisted by the installation of an anemometer at KVAR2.

12. The installation of a camera provides an excellent addition to the KVAR2 monitoring network and the images could be very useful in assessing potential impacts from KVAR2. It is suggested that the images collected to date be reviewed to ensure that they are suitable for the above purposes, should the need arise in the future.

1. INTRODUCTION

In 2002, Delta Electricity obtained approval for conversion of the wet slurry ash placement process at Wallerawang Power Station to dry ash. The dry ash repository was established at the Kerosene Vale open cut coal mine void site, on top of the original wet ash dam, Kerosene Vale Ash Dam (KVAD). When the KVAD was full of ash, wet ash placement was directed to the Sawyers Swamp Creek Ash Dam (SSCAD) from 1980, and ultimately the KVAD was capped with clay so dry ash placement could be undertaken.

The dry placement is called the Kerosene Vale Ash Repository (KVAR). Stage 1 of the placement was completed and capped in February 2009. Approval was obtained for further placement in the Stage 2 Area at the KVAR in November, 2008 with placement in the Stage 2 area commencing in April, 2009. The locations of the various ash dams and repositories are shown in **Figure 1**.

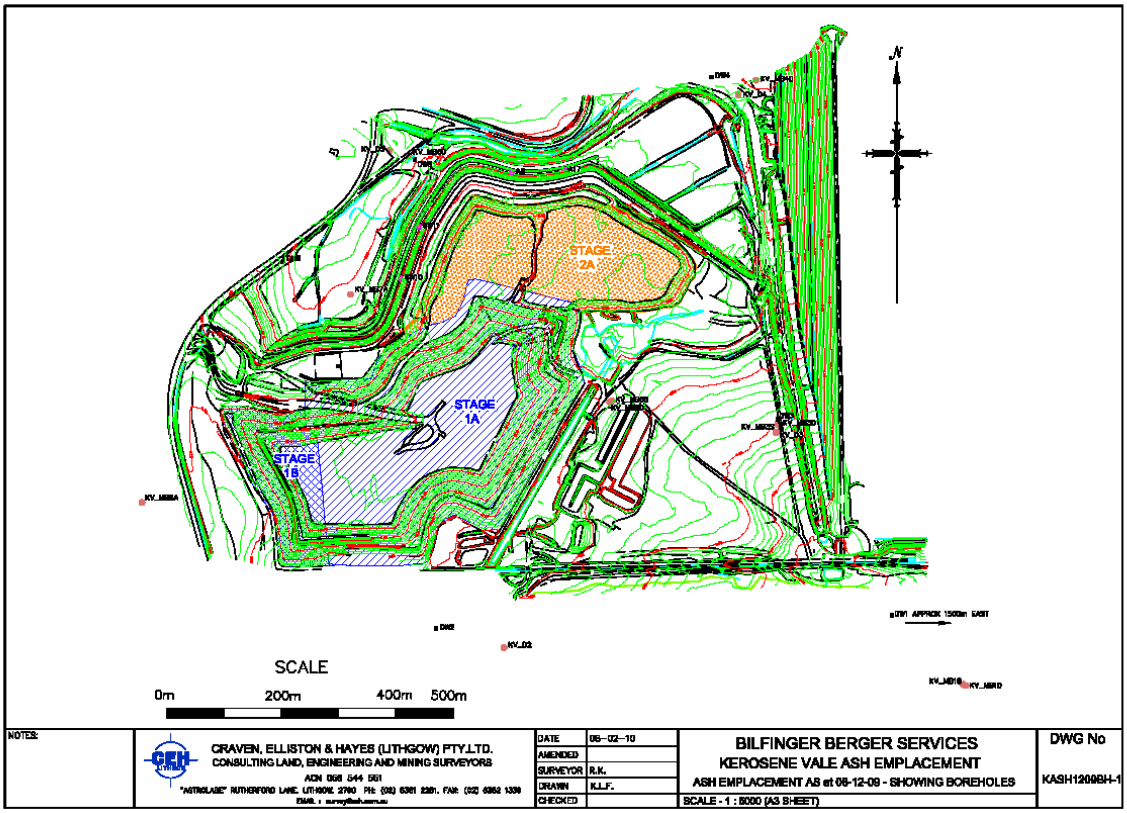

Figure 1: The location of Stage 1 and Stage 2 operations in the Kerosene Vale Ash Repository.

Stage 2 of KVAR (KVAR2) was subject to assessment under Part 3A of the Environmental Planning and Assessment Act 1979 and as required by the Approval Conditions, Delta Electricity prepared an Operation Environmental Management Plan (OEMP) prior to the commencement of KVAR2. The OEMP includes an Air Quality Management Plan, which includes monitoring and reporting requirements.

Malfroy Environmental Strategies Pty Ltd (M_E_S) has been engaged by Delta Electricity to review the air quality monitoring data collected during the first year of KVAR2 operations and to report on the results against the requirements of the OEMP. In undertaking this data review, some comments and observations are made on the operation of the air quality management plan.

2. The KVAR2 AIR QUALITY MANAGEMENT PLAN

The key objective of the KVAR2 air quality management plan is "*to manage resources effectively to ensure the prevention of conditions that may lead to visible dust emissions."* (PB 2009, p. 77)

The air quality management plan includes the following performance measures.

Targets:

- The local air quality in the vicinity of the KVAR is not impacted by Stage 2 operations;
- Zero incidence of dust-related complaints

Indicators:

- Zero visible dust events in vicinity of Kerosene Vale Ash Repository during Stage 2 operations
- Complaints register demonstrating zero occurrence of dust related complaints.

The Plan states that "*Through the use of dust suppression equipment and the implementation of air quality management procedures, dust events can be controlled*." (PB, 2009 p. 77)

The detailed list of management and mitigation measures in the Plan is included in **Appendix 1.** These measures are monitored by Delta's Ash Placement Contractor, Bilfinger Berger Services (BBS), and are reported at BBSs Monthly Contract Review Meetings. The measures include:

- Moisture conditioning of ash;
- Covering of ash loads in trucks;
- Wheel and undercarriage washes;
- Temporary capping of ash faces not currently in use and where irrigation systems are not in operation;
- Routine maintenance of truck washes, and washout/surface drainage pits;
- Routine washing of private haul roads within KVAR2;
- Use of water cart, as required;
- Dedicated sprinkler system;

2.1 Air quality monitoring

The air quality management plan includes the following monitoring requirements (PB, 2009):

- *A total of 7 deposition gauges shall be used to monitor dust emissions at the perimeter of the ash repository area, and at key locations adjacent to residential properties and Wallerawang Power Station. This includes the existing 5 dust deposition gauges and the installation of an additional 2 dust deposition gauges*

Note: The positioning of the additional 2 gauges has been reviewed by specialist consultants based on a review of local weather patterns and the sensitivity of surrounding properties and will be subject to landowner approval.

- *Samples shall be removed from the dust deposition gauges on a monthly basis by a NATA approved laboratory and assessed for compliance with the appropriate air quality criteria.*

- *The DECC amenity-based criteria for dust fallout is a maximum total dust deposition of 4 g/m²/month (annual). The Stage 2 operations shall aim to achieve compliance with this limit.*

- *If the 4 g/m²/month limit is exceeded by more than 2 g/m², a review of the effectiveness of the dust suppression regime and further mitigation measures shall be undertaken including:*

    - *increased application rates of the irrigation system at the ash working face*
    - *increased application rates of water on haul roads, particularly during high wind events*
    - *further reduction in the ash face working area below1.5 hectares*
    - *increased implementation of temporary capping such as PVA, lignosulphate or tar where un-worked ash faces still exist*
    - *the application of higher ash moisture rates through the silo humidifier*

2.2 Reporting

The air quality management plan includes the following reporting requirements (PB, 2009):

- *Delta Electricity shall issue a report to the DECC every 12 months from commencement of operations. The report shall contain the location, frequency, rationale and the procedures and protocols for collecting air quality samples as well as the parameters analysed and methods of analysis.*

- *The results and analysis of the monitoring data shall also be included and assessed against the air quality criteria (4 g/m²/month) and the baseline data provided in Table D of Appendix C. In the case of exceedences; the response taken must be documented within the report. Any deviations from the proposed monitoring program must also be justified.*

- *The Annual Environmental Management Report will be submitted to the Director-General complete with air quality monitoring data gathered throughout the year.*

This report explicitly addresses the above monitoring and reporting requirements.

3. THE MONITORING PROGRAM

3.1 OEMP dust gauges locations

The locations of the 5 existing dust gauges specified in the OEMP are shown in **Figure 2**.

The approximate distances of the existing gauges from the nearest KVAR2 boundary are shown in **Table 1**. With the exception Gauge 29, all other gauges are well beyond the perimeter of KVAR2 and from **Figure 2** it can be seen that, in some cases the gauges are nearby other potential dust sources, such as disturbed areas, mining activity and other power station operations.

Table 1: Existing dust gauges – distances from KVAR2

Gauge number	Approximate distance (m) from KVAR2
5	1,000
27	1,300
28	1,500
29	50
30	1,000

The OEMP specifies the installation of 2 new dust gauges in the residential area of Lidsdale approximately 200 and 600 metres to the west and south-west of KVAR2. Delta Electricity has indicated that installation of these gauges is scheduled to be undertaken by the end of 2010.

3.2 KVAR2 on-site gauges

In addition to the gauges included in the OEMP, BBS, maintain a network of 8 dust gauges located on the perimeter of KVAR2, inside the working-area of KVAR2 and one additional gauge at the silo at Wallerawang Power Station where ash is conditioned and transferred to truck for transport to KVAR2. The locations of these gauges are shown in **Figure 3**.

These gauges are primarily used for Workplace Health and Safety monitoring, and inclusion of these results is not a project Approval Condition or a requirement of the OEMP, however these data are considered in this report to provide a more comprehensive assessment of potential dust impacts from KVAR2.

Figure 2: The location of the 5 OEMP dust gauges

Figure 3: Location of dust gauges operated in and on the perimeter of KVAR2 operated by the site contractors. Note that DM9 is located at the ash silo about 1,500m to the south-west at Wallerawang Power Station.

3.3 Other Delta Electricity dust gauges

The existing dust gauges shown in **Figure 2** and **Table 1** form part of a broader regional network operated by Delta Electricity for several decades. The current Delta Electricity dust gauge network is shown in **Appendix 2** and data from the network are considered in this report.

3.4 Anemometer

There are plans to install an anemometer on-site at KVAR2 but until this occurs BBS has made use of wind data collected at the Mt Piper ash disposal area about 7 km to the north-west of KVAR2. The anemometer at this site is located on a 2 metre stand.

3.5 Frequency and methods

Table 2 presents details regarding the installation and operation of the dust monitoring network equipment.

The Delta Electricity and BBS gauges are maintained by, and samples analysed by, ACIRL Ltd who have NATA accreditation for the relevant Australian Standard.

Table 2: Frequency of Measurements and Monitoring Methods

Parameter	*Frequency of measurement*	*NSW Approved Method (AM)and Australian Standard (AS)*
Dust gauges	Monthly	• AM-1 Guide for the siting of sampling units (AS 2922 – 1987) • AM-19 Particulates – deposited matter – gravimetric method (AS 3580.10.1 1991)

The collected samples are analysed in the laboratory according to AS 3580 for:

- Insoluble solids: this is the matter that does not dissolve in water.
- Incombustible (ash)[1] content: this is the matter that remains after the sample has been combusted in the laboratory.

Results for insoluble solids and incombustible material are expressed as g/m^2/month.

The incombustible (ash) content provides an indication of the mineral content of the sample. The mineral content may be attributable to industry, but may also be attributable to other sources such as agriculture, unsealed roads and "natural" windblown dust.

Dust gauge data, including the ash and combustible fractions can provide information on possible sources of the dust but due to the time-scale over which data are collected (monthly) and the fact that many disparate sources can contribute to deposited dust, it is often not possible to use dust gauge data to positively identify the contributing sources.

4. RESULTS

Data are presented for the first year of ash placement in KVAR2, commencing in April 2009.

4.1 OEMP gauges

Table 3 presents the monthly dust deposition results for the 5 OEMP gauges for which data are available for the first year of operation of KVAR2. During late September 2009 and particularly on the 23rd and 26th much of eastern Australia experienced severe dust storms and the impact of these storms are evident in the September and October[2] dust gauge data for the Western Coalfields area. The dust storm impact is evident in **Table 3** which includes annual averages with all data included and with the September and October data excluded. For some gauges, the very high deposition rates in September and October increased the annual average by more than a factor of 2.

[1] Ash content does not refer to coal ash but could include ash from coal combustion and other mineral matter derived from soil, for example.

[2] The dust gauges were serviced on the 25th September, so the event of the 26th of September is included in the October dust gauge data.

Table 3: Dust gauge data from the OEMP gauges for the first year of KVAR2 operations (April 2009 – March 2010

Insol – Insoluble solids, g/m^2/month, **Ash** – Incombustible material, g/m^2/month; **Frac**. – Ash fraction of insoluble solids.

Gauge / Month	5			27			28			29			30		
	Insol.	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**
April	0.3	0.1	0.3	3.3	2.6	0.8	2.1	1.6	0.8	2.2	1.8	0.8	0.6	0.2	0.3
May	1.1	0.8	0.7	2.5	1.4	0.6	1.9	1.3	0.7	2.6	1.9	0.7	0.6	0.2	0.3
June	0.5	0.2	0.4	6.4	2.7	0.4	1.3	0.9	0.7	2.2	1.5	0.7	< 0.1	< 0.1	1.0
July	0.4	0.2	0.5	9.6	7.2	0.7	1.0	0.6	0.6	3.4	2.7	0.8	0.2	0.2	1.0
August	0.1	< 0.1	1.0	12.9	10.0	0.8	2.0	1.2	0.6	3.8	2.6	0.7	1.1	0.5	0.4
September	24.4	21.0	0.9	48.2	30.7	0.6	20.7	17.6	0.9	14.7	12.4	0.8	16.2	13.7	0.8
October	7.6	6.2	0.8	20.9	12.8	0.6	9.4	7.8	0.8	8.1	6.7	0.8	6.8	5.6	0.82
November	1.1	0.7	0.6	32.3	12.3	0.4	2.8	2.0	0.7	3.8	3.0	0.8	2.4	1.2	0.50
December	7.3 #	2.1	0.3	24.2	5.4	0.2	4.1	3.0	0.7	3.8	2.9	0.8	2.6	1.9	0.73
January	3.0	1.4	0.5	5.9	2.4	0.4	3.4	1.8	0.5	1.7	1.1	0.6	1.2	0.4	0.3
February	0.2	< 0.1	0.5	3.3	1.3	0.4	5.5	4.5	0.8	1.9	1.2	0.6	0.7	0.3	0.4
March	0.2	< 0.1	0.5	3.0	1.1	0.4	1.5	0.5	0.3	1.4	0.9	0.6	0.3	< 0.1	0.3
Average (1)	**3.9 (1.4)**	**2.8 (0.6)**	**0.6 (0.5)**	**14.4 (10.3)**	**7.5 (4.6)**	**0.5 (0.5)**	**4.6 (2.6)**	**3.6 (1.7)**	**0.7 (0.7)**	**4.1 (2.7)**	**3.2 (2.0)**	**0.7 (0.7)**	**2.7 (1.0)**	**2.0 (0.5)**	**0.6 (0.5)**
Months > 4 (1)	3 (1)	2 (0)	-	8 (6)	6 (4)	-	4 (2)	3 (1)	-	2 (0)	2 (0)	-	2 (0)	2 (0)	-
Months > 6 (1)	3(1)	2 (0)	-	7 (5)	5 (3)	-	2 (0)	2 (0)	-	2 (0)	2 (0)	-	2 (0)	2 (0)	-

1. Averages and months in brackets exclude September and October 2009 data.

bird droppings in gauge

With the September and October dust storm data excluded, only Gauge 27 recorded an annual average deposition rate exceeding the criterion of 4 (and 6) g/m^2/month. From **Table 1** and **Figure 2** it can be seen that Gauge 27 is located about 1,500 metres from KVAR2, on Wallerawang Power Station land and in close proximity to a live coal storage area and adjacent to a public road. Results from Gauge 27 are the highest of all gauges in most months (and often much higher) and tend to significantly elevate the monthly average of the 5 OEMP gauges (**Table 5**).

In contrast Gauge 29 is the closest of the OEMP gauges to KVAR2 and its annual average (excluding September and October data) was 2.7 g/m^2/month and with an "ash" fraction of 0.7. With September and October data excluded, no months at Gauge 29 recorded deposition above 4 g/m^2/month.

Figure 4 shows the annual average deposition rates of the incombustible ("ash") component of the deposited dust at the 5 OEMP gauges over 4 calendar years. The "ash" component is plotted on the basis that if emissions from KVAR2 were impacting in the local area, these impacts would appear as increased deposition of incombustible (ash) material. As would be expected results show year-to-year variation and in 2009 – 2010, the first year of KVAR2 operation, 2 of the 5 OEMP gauges (27 and 28) recorded the highest deposition over the 4 year period. Due to the relative distance of Gauges 27 and 28 from KVAR2 (**Table 1, Figure 2**), it is unlikely that the ash repository is the source of the elevated readings. This is further confirmed by the fact that deposition rates at the nearest OEMP gauge to KVAR2 (Gauge 29) did not increase during the first year of operation when deposition was the equal lowest of the four years.

Figure 5 shows similar results for the group of 15 "other" Delta Electricity gauges. In this case 5 of the 15 gauges (2, 9, 22, 23, and 24) recorded the highest deposition rate in 2009 for the 4 year period while a similar number recorded the lowest deposition rate in 2009 for the 4 year period.

Gauge 25 which recorded the highest deposition rates of all gauges in all years is notable as it is located within about 100m of KVAR2 and adjacent to the Wallerawang coal haul road. Vehicle generated dust from this road (due to re-suspension of fugitive ash particles) would appear to be the source of the high deposition rates at this gauge relative to the other gauges in the network.

4.2 KVAR2 gauges

The OEMP does not require that results from the on-site BBS on-site gauges be included in the annual report. The results for the first year are included in **Table 4** for completeness and also to demonstrate that gauges located at the perimeter of KVAR and to the west of the site (1, 4 and 7) nearer residential areas, recorded annual average deposition rates below 4 g/m^2/month (as an annual average and with September data excluded). Excluding September data, only two monthly results from these gauges exceeded 6 g/m^2/month.

Gauge 9 is located adjacent to the ash loading silo at Wallerawang Power Station and it would appear to be influenced by the ash operations, as indicated by the high average ash fraction of 0.8 compared with the other sites, which despite being located on or adjacent to the ash placement area are influenced by other dust sources which have a lower incombustible (ash) fraction.

With September data excluded on the basis of being significantly affected by regional dust storms, Gauges 2, 3, 5 and 8 recorded annual deposition rates equal to or exceeding 6 g/m^2/month. **Figure 2** shows that with the exception of Gauge 2 these gauges are located well inside the perimeter of KVAR2.

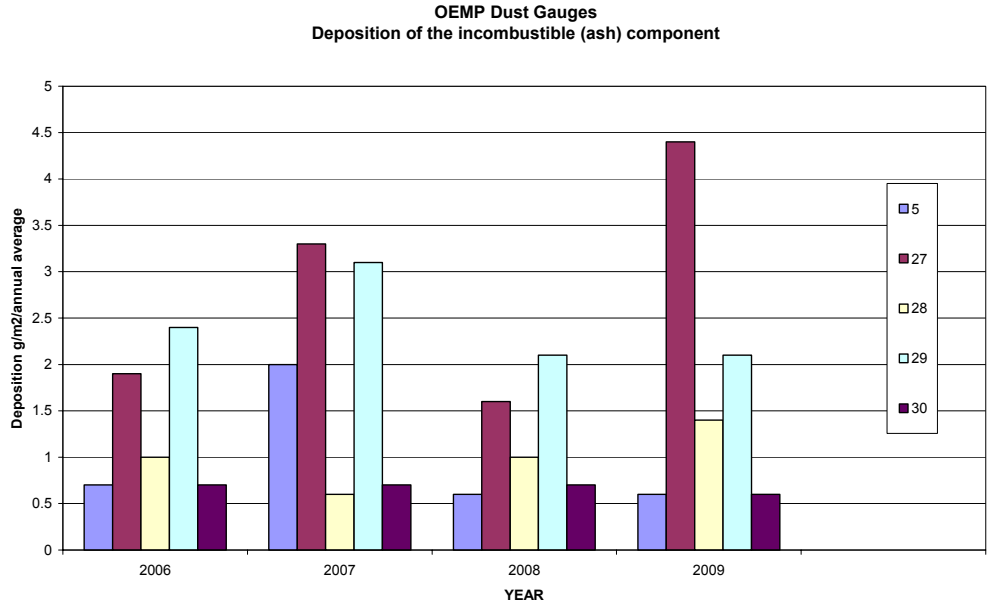

Figure 4: OEMP gauge "ash" deposition 2006 - 2009

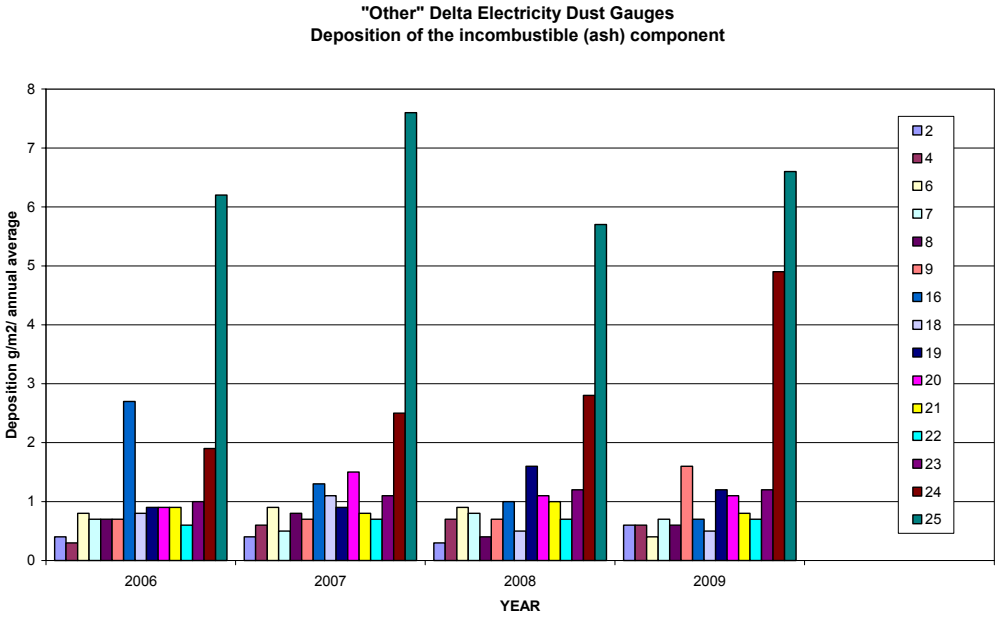

Figure 5: Ash deposition at other Delta Electricity gauges, 2006 – 2009.

Table 4: Dust gauge data from the on-site gauges for the first year of KVAR2 operations (April 2009 – March 2010)

Insol – Insoluble solids, g/m^2/month, **Ash** – Incombustible material, g/m^2/month; **Frac**. – Ash fraction of insoluble solids

Gauge / Month	1			2 (1)			3 (1)			4			5		
	Insol.	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**
April	0.9	0.6	0.7	1.9	1.4	0.7	1.5	0.9	0.6	1.2	0.9	0.7	1.3	1.0	0.8
May	1.7	1.5	0.9	-	-	-	1.2	0.7	0.6	1.2	0.9	0.7	0.2	0.0 (3)	0.00 (3)
June	0.6	0.4	0.7	0.7	0.4	0.6	-	-	-	0.4	0.1	0.2	0.5	0.4	0.8
July	0.4	0.1	0.3	-	-	-	7.7	3.4	0.4	0.4	0.2	0.5	1.1	0.5	0.4
August	5.1	3.6	0.7	-	-	-	0.9	0.5	0.6	1.9	1.4	0.7	2.1	0.9	0.4
September	10.8	9.3	0.9	-	-	-	11.1	9.4	0.8	20.6	17.7	0.9	15.5	13.6	0.9
October	3.7	3.0	0.8	-	-	-	40.8	33.8	0.8	-	-	-	29.9	17.7	0.6
November	3.0	2.5	0.8	3.0	2.2	0.8	9.0	6.2	0.7	3.0	2.0	0.8	20.0	11.6	0.6
December	2.0	1.2	0.7	6.0	4.8	0.8	6.0	3.7	0.6	1.0	1.1	0.8	6.0	3.1	0.5
January	14.1	6.5	0.5	16.6	10.6	0.6	1.7	1.2	0.7	1.8	1.2	0.7	9.2	6.2	0.7
February	2.9	2.5	0.9	1.6	1.0	0.6	9.4	5.5	0.6	0.7	0.3	0.4	6.6	4.4	0.7
March	1.3	0.9	0.7	12.9	6.2	0.5	12.1	7.9	0.6	1.7	1.4	0.8	23.4	8.6	0.4
Average (2)	3.9 (3.2)	2.7 (2.1)	0.7 (0.7)	6.0 (6.0)	3.8 (3.8)	0.7 (0.7)	9.2 (9.0)	6.7 (6.4)	0.6 (0.6)	3.1 (1.3)	2.5 (2.0)	0.7 (0.7)	9.7 (9.2)	5.7 (4.9)	0.6 (0.5)
Months > 4	3 (2)	2 (1)	-	3 (3)	3 (3)	-	7 (6)	5 (4)	-	1 (0)	1 (0)	-	7 (6)	6 (5)	-
Months > 6	2 (1)	2 (1)	-	2 (2)	2 (2)	-	6 (5)	4 (3)	-	1 (0)	1 (0)	-	6 (5)	5 (4)	-

1. Gauge location moved in August 2009. Gauge 2 moved to the east about <400> metres.
   Gauge 3 from dirt south-east boundary, to the edge extent of ash repository on eastern side within ash repository Stage II operations.
2. Averages and months in brackets exclude September 2009 data.
3. As reported

Table 4 (continued): Dust gauge data from the on-site gauges for the first year of KVAR2 operations (April 2009 – March 2010).

Insol – Insoluble solids, g/m^2/month, **Ash** – Incombustible material, g/m^2/month; **Frac**. – Ash fraction of insoluble solids

Gauge / Month	6			7			8			9		
	Insol.	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**	**Insol.**	**Ash**	**Frac.**
April	2.2	1.9	0.9	2.2	1.7	0.8	0.5	0.2	0.4	3.9	3.1	0.8
May	1.1	0.5	0.5	1.2	0.8	0.7	6.1	4.0	0.7	8.5	7.3	0.9
June	0.5	0.1	0.2	1.0	0.5	0.5	4.8	4.3	0.9	8.8	7.7	0.9
July	3.2	2.2	0.7	1.9	1.1	0.6	0.9	0.7	0.8	8.1	7.3	0.9
August	5.3	3.8	0.7	2.6	1.7	0.6	4.1	2.7	0.7	9.1	8.2	0.9
September	16.1	10.8	0.7	21.7	18.3	0.8	19.8	14.2	0.7	31.3	27.3	0.9
October	11.4	8.8	0.8	7.1	5.8	0.8	5.6	3.7	0.7	11.1	9.6	0.9
November	3.0	1.8	0.6	5.0	3.7	0.8	15.0	10.5	0.7	8.0	7.0	0.8
December	5.0	2.9	0.6	2.0	1.9	0.8	11.0	5.2	0.5	3.0	2.3	0.7
January	2.7	1.3	0.5	2.2	1.6	0.7	3.1	2.4	0.8	2.5	2.1	0.8
February	14.1	7.2	0.5	1.7	1.4	0.8	6.0	3.6	0.6	2.1	1.7	0.8
March	7.4	3.8	0.5	3.6	3.1	0.9	14.4	12.7	0.9	4.6	3.8	0.8
Average (1)	6.0 (5.1)	3.8 (3.1)	0.5 (0.6)	4.4 (2.8)	3.5 (2.1)	0.7 (0.7)	**7.6 (6.5)**	5.4 (4.5)	0.7 (0.7)	8.5 (6.4)	**7.3 (5.5)**	0.8 (0.8)
Months > 4	6 (5)	3 (2)	-	3 (2)	2 (1)	-	9 (8)	5 (4)	-	8 (7)	7 (6)	-
Months > 6	4 (3)	3 (2)	-	2 (1)	1 (0)	-	5 (4)	3 (2)	-	7 (6)	7 (6)	-

1. Averages and months in brackets exclude September 2009 data.

4.3 Monthly averages

Table 5 presents monthly average dust deposition rates across the OEMP and BBS gauges and shows deposition tended to be lower in the first half of the year than in the latter half of the year.

Table 5: Monthly dust deposition averages g/m2/month and ash fraction (including September and October data)

	Insoluble solids g/m^2/month		**Ash** g/m^2/month		**Ash fraction %**	
	OEMP	**BBS**	**OEMP**	**BBS**	**OEMP**	**BBS**
March 2009	1.6	3.4	1.2	2.5	0.7	0.7
April	1.7	1.7	1.2	1.3	0.6	0.7
May	1.7	2.7	1.1	2.0	0.6	0.6
June	2.1	1.9	1.1	1.7	0.6	0.6
July	2.9	3.0	2.2	1.9	0.7	0.6
August	4.0	3.9	2.9	2.9	0.7	0.6
September	24.8	18.4	19.1	15.1	0.8	0.8
October	10.6	15.7	7.8	11.8	0.8	0.7
November	8.5	7.6	3.8	5.3	0.6	0.7
December	8.4	4.8	3.1	2.9	0.6	0.7
January 2010	3.0	6.0	1.4	3.7	0.5	0.7
February	2.3	5.0	1.5	3.1	0.5	0.7
March	1.3	9.0	0.5	5.4	0.4	0.7

4.4 Ash fractions

Table 6 shows very little difference in the average ash fraction from OEMP gauges from the first year of operation of KVAR2 compared with the 2006 – 2008 average. The table also shows little difference in the average ash fraction of OEMP and BBS gauges, with the exception of BBS Gauge 9, located close to the ash silo transfer point.

Table 6: Ash fractions in OEMP, BBS and "other" gauges in the first year of KVAR2 operations (April 2009 – March 2010)

	Highest	Lowest	Mean 2009-10	2006- 2008
OEMP gauges				
5	0.9	0.3	0.6	0.6
27	0.8	0.2	0.6	0.6
28	0.8	0.5	0.7	0.5
29	0.8	0.6	0.8	0.8
30	0.8	0.4	0.7	0.6
BBS gauges				
1	0.9	0.3	0.7	-
2	0.9	0.4	0.7	-
3	0.9	0.4	0.6	-
4	0.9	0.3	0.6	-
5	0.9	0.4	0.5	-
6	0.9	0.2	0.6	-
7	0.8	0.5	0.7	-
8	0.90	0.4	0.7	-
9	**0.9**	**0.7**	**0.8**	-

5. COMPLAINT REGISTERS

Both Delta Electricity and BBS maintain registers which record the details of complaints received by members of the public and a description of any investigation into, and corrective action taken in response to, the complaint.

Since the commencement of KVAR2, neither Delta Electricity nor BBS have received any complaints related to emissions from the facility. There was one complaint in May 2009 regarding ash trucks operating on the coal haulage road with ash uncovered and therefore a potential source of dust in the ambient environment. Delta's complaint register noted that:

".....One of these trucks had a faulty cover but was required for use as no other trucks were available. Complainant satisfied with explanation of situation."

BBS produces a Monthly Monitoring Review Environmental Report for KVAR2, which includes a section on reporting dust related complaints. Since the commencement of KVAR2 reporting in early 2009 no complaints have been recorded.

6. AIR QUALITY MANAGEMENT PLAN REQUIREMENTS

Although addressed, at least in part, in previous sections, this section explicitly addresses the specific requirements of the KVAR2 OEMP and Air Quality Management Plan.

The key objective of the KVAR2 air quality management plan is "*to manage resources effectively to ensure the prevention of conditions that may lead to visible dust emissions."* (PB, 2009 p. 77)

While not specifically included in the M_E_S reporting brief, during an inspection of KVAR2 and surrounding areas on the 27th April, 2010, the range of management measures included in the OEMP to minimise dust emissions were observed to be operating and no visible dust was being generated by KVAR2 operations.

The OEMP includes the following performance measures:

Targets:

- The local air quality in the vicinity of the KVAR is not impacted by Stage 2 operations;
- Zero incidence of dust-related complaints

Indicators:

- Zero visible dust events in vicinity of Kerosene Vale Ash Repository during Stage 2 operations
- Complaints register demonstrating zero occurrence of dust related complaints.

With respect to the first target, data presented in Section 4 demonstrated that Stage 2 operations are not adversely impacting on dust deposition levels in the vicinity of KVAR2.

As noted in the previous section, both Delta Electricity and LLI have systems in place to receive, record and respond to complaints. During the first year of operation of KVAR2 no complaints directly related to dust emissions from the facility were received by either Delta Electricity or the site contractors.

It is not possible with the data available to make any comment regarding the indicator of *zero visible dust events in vicinity of KVAR2 operations*, although as discussed in the next section, the camera installed at KVAR2 might be used in the future to assess performance against this objective.

Air quality monitoring

The OEMP specifies 5 existing dust gauges and 2 new gauges. As discussed above, and further in the next section, the 2 new gauges have yet to be installed.

The OEMP adopts the aim of complying with the 4 g/m^2/month (as an annual average) amenity limit. As documented in **Table 3** and **Table 7** dust deposition at 4 of the 5 OEMP gauges was less than the 4 g/m^2/month (annual) in the first year of operation **(**subject to the omission of regional dust storm data).

Dust deposition at Gauge 27 exceeded 4 (and 6) g/m^2/month (annual) but as discussed previously, and further in the next section, elevated OEMP dust gauge results are not necessarily caused by emissions from KVAR2 and some of the OEMP gauges, and in particular Gauges 27 and 28 are poorly located for the purpose of identifying impacts from KVAR2. Therefore, the elevated results recorded at Gauge 27 are most unlikely to be significantly affected by emissions from KVAR2.

Reporting

The OEMP includes reporting requirements, such as *location frequency, rationale and the procedures and protocols for collecting air quality samples as well as the parameters analysed and methods of analysis.* These requirements are addressed in Section 3 of this report.

The reporting requirement for the OEMP data to be assessed against the 4 g/m^2/month criterion has been addressed immediately above.

The OEMP also requires the data *to be assessed against the baseline data provided in Table D of Appendix C* (of the air quality assessment). **Table 7** reproduces the data from the referenced Table D and adds to it more recently collected data, including from the first year of KVAR2 operations (April 2009 – March 2010).

Table 7 shows that average dust levels at the OEMP gauges vary from year-to-year, as expected. For 4 of the 5 gauges, deposition rates in the first year of KVAR2 were within the range recorded in previous years. The results do not indicate any change due to KVAR2 operations, particularly at Gauge 29 which is closest to KVAR2. Results from Gauge 29 during the first year of KVAR2 operations were the third lowest of the dry ash placement period (2002 – 2009 – 10).

As discussed above and elsewhere, Gauge 27 (and 28) is poorly located for the purpose of identifying impacts from KVAR2. The elevated results recorded at Gauge 27 are most unlikely to be significantly affected by emissions from KVAR2.

Table 7: Annual average dust deposition recorded by OEMP gauges

		Dust Gauge, Annual average g/m^2/annual average				
		DG5	**DG27**	**DG28**	**DG29**	**DG30**
From Table D	**2002**		1.7	2.2	1.2	0.8
	2003		1.3	2.1	7.4	0.8
	2004		1.8	1.3	5.3	0.7
	2005		5.7	2.0	4.9	1.0
	2006	1.2	3.2	4.9	3.0	1.0
	Jan – Jun 2007	1.0	3.9	1.8	3.0	1.1
More recent data	**2007**	2.7	5.0	1.1	3.7	1.0
	2008	1.0	2.8	1.8	2.6	1.2
	Apr 2009 – Mar 2010 (Excluding dust storms)	**1.4**	**10.3**	**2.6**	**2.7**	**1.0**
	Apr 2009 – Mar 2010 (Including dust storms)	3.9	14.4	4.6	4.1	2.7

7. DISCUSSION

Dust gauges are often positioned adjacent to dust generating activities to assess possible nuisance impacts at nearby receptors. As a passive collection system they are inexpensive to install but are subject to a number of limitations:

- They are more effective in collecting coarse particles than fine particles;
- Results are often influenced by things like insects, bird droppings and sometimes by human interference;
- The collection period of a month makes the assessment of short-term individual events impossible;
- Without further analysis it is difficult, if not impossible, to use dust gauge results to discriminate between a number of possible sources;

Notwithstanding these limitations, dust gauge data have the potential to provide some relevant information regarding the potential dust impacts arising from KVAR2.

The first is that huge regional dust storms which swept across eastern Australia[3] in late September contributed significantly to the highest monthly deposition rates in 2009 – 2010. While local sources would also have contributed to these events, their contribution is likely to be minor in comparison to the regional storms and any attempt to assess the potential impact of the local dust sources over the year needs to take these large-scale events into account.

Secondly, in relation to dust gauge samples, "ash" refers to the incombustible, inorganic fraction of the sample and the "ash" fraction of a sample can not be directly related to coal-ash. This point is illustrated by data from September 2009 during which time the KVAR2 dust gauge results were clearly influenced by the regional dust events. The ash fractions of the samples collected during this month were generally high, at about 0.82, indicating the dominance of inorganic, crustal material. BBS Gauge 9, which is located near the ash silo at Wallerawang Power Station shows ash fractions above 0.8 in most months and in this case most likely due to fugitive ash emissions from the transfer process. The emissions are the inorganic, incombustible remains following coal combustion. This point is considered in more detail later in this discussion, but here it is noted that a high "ash" fraction does not necessarily indicate ash from coal combustion.

Related to the above discussion is the OEMP's requirement that:
If the 4 g/m2/month limit is exceeded by more than 2 g/m2/month a review of the effectiveness of the dust suppression regime and further mitigation measures shall be undertaken…

This requirement appears to be based on the simplistic assumption that any measured increase in dust deposition at OEMP gauges is the result of emissions from KVAR2. A diverse range of sources (including regional dust storms, as noted above) can contribute to dust gauge results and, as noted previously, some OEMP dust gauges are poorly located for the purpose of identifying impacts from KVAR2. Care must be exercised in attempting to relate dust deposition results to potential dust sources. The contributing source, or sources, to an elevated result can not always

[3] See DustWatch website http://www.environment.nsw.gov.au/dustwatch/dwreports.htm

simply or easily be determined. It follows that prior to reviewing *the effectiveness of the (KVAR2) dust suppression regime* that some effort should be made to determine the likely contribution of KVAR2 operations to the dust event(s).

As noted above, dust gauges are most commonly used adjacent to, or in close proximity to, potentially "dusty" activities. With respect to the location of the OEMP gauges it should be noted that data obtained from gauges located at some distance from KVAR2 are unlikely to provide robust, useful information regarding potential impacts from the KVAR2. Of the existing 5 OEMP gauges it is considered that only Gauge 29, which is adjacent to KVAR2 (**Figure 2**) is likely to provide information which is useful in assessing potential impacts from KVAR2. With the dust storm event data removed, it was shown (**Table 3**) that no month recorded a deposition rate in excess of 4 g/m^2/month at Gauge 29.

It is considered that OEMP Gauges 5, 27, 28 and 30 are too far away to provide data relevant to assessing KVAR2 impacts. Gauge 5 might be considered to provide "background" data but the only use for gauge locations 27 and 28 should be to monitor potential dust deposition from Wallerawang Power Station's coal stack. The elevated results recorded at Gauge 27 are often associated with a relatively low "ash" fraction and are most unlikely to be related to KVAR2 operations. It is also noted that Gauge 27 is locate adjacent to a public road and the possibility of occasional human interference with the operation of the gauge can not be rule out.

Gauges 5, 28 and 29 recorded an annual average deposition rate of less than 4 g/m^2/month with the exclusion of the September dust storm data.

A comparison of dust data from the first year of operation of KVAR2 with data collected in previous years showed no indication of an increase in dust deposition levels, particularly at Gauge 29, the closest to KVAR2.

Currently 5 of the 7 gauges included in the OEMP are in operation. Two (as yet, un-numbered) gauges are to be located in the residential area of Lidsdale to the immediate west of KVAR2 **(Figure 2).** It is considered that gauges at these proposed locations will be of more relevance and use than the more distant gauges, such as 27 and 28, and should be installed as soon as possible. Consideration could also be given to installing directional dust gauges, as well as standard dust gauges, at OEMP sites to provide additional indication regarding potential dust sources.

While a number of results from the BBS gauges recorded annual results, equal to and above the criterion of 6 g/m^2/month it should be noted that these gauges (2, 3, 5 and8) are positioned primarily for monitoring Work Place Safety requirements, and are located well within the perimeter of KVAR2. Results from gauges located on the perimeter of the site (1, 4 and 7) were less than 4g/m^2/month on average (with September data excluded), indicating that elevated dust levels were not leaving the site (in these directions). It is also of note that the average ash fraction of gauges 2, 3, 5 and 8 varies between about 0.5 and 0.7, indicating sources with a significant combustible fraction contribute to the dust results on KVAR2. For example, Gauge 5 recorded a very high insoluble solid deposition rate of 23 g/m^2/month in March with a (low) ash fraction of 0.4. While emissions from KVAR2 may have contributed to the result, the low ash

fraction indicates a source (or sources) which was dominantly combustible (organic) contributed significantly to this result.

When the dust gauge material is analysed on a monthly basis for insoluble solids, ash and combustible fractions, the analysts provide a description of the collected material, based on visual inspection including colour, size (fine, coarse etc) and if possible the composition of the collected material, which might typically include the following: bugs, organics, plant material, spiders, bird droppings – as well as the more generic "dust". The colour of the collected dust is variously described as black, brown, grey and green (perhaps due to biological activity). If coal-ash from KVAR2 were making a significant contribution to deposited dust levels, it might be expected that the collected ash would be described as grey (the colour of the coal-ash varies from light to dark grey), on a regular basis.

BBS Gauge 9 is located at the ash transfer facility at Wallerawang Power Station – and 8 of the 12 monthly samples include "grey" as a descriptor, suggesting coal-ash may be contributing at this site –and this possibility is supported by the high "ash" fraction of about 0.84 at this site compared with other sites. Of the BBS gauges located at KVAR2 only 14 out of 98 monthly samples (about 15%) included "grey" as a descriptor. Similarly, of the 60 OEMP monthly dust samples only 8 out of 60 (about 13%) included grey as a descriptor. Half of these observations were from Gauge 29, which is positioned closest to KVAR2.

These qualitative visual observations provide further support for the proposition that dust emissions from KVAR2 did not contribute adversely to measured deposition results in 2009 – 2010. Further support for this conclusion could be provided by the use of microscopic examination of a number of collected samples. Such examination could distinguish between "ash" samples which are dominantly crustal material and "ash" samples resulting from coal combustion that are characterised by spherical particles of varying diameter.

Interpretation of the dust gauge data might also be assisted by the installation of an anemometer at KVAR2 as the current anemometer at Mt Piper, about 7km to the north-west and positioned 2 metres above ground level, is unlikely to provide data representative of conditions at KVAR2.

Finally, during the site inspection of KVAR2, the location of a permanently located camera was observed and Delta Electricity subsequently provided M_E_S with a sample of images taken by the camera. The camera scans the KVAR2 area taking photographs from 8 positions at intervals from about 10 to 30 seconds. It is considered that the camera provides an excellent addition to the monitoring network and that the images could be very useful in assessing potential impacts from KVAR2 – firstly, in confirming or dismissing KVAR2 as a source of visible dust and secondly, if the camera images confirm that "dusting" from KVAR2 occurred, identification of the conditions under which dusting occurred might then enable effective corrective measures to be implemented. It is suggested that the images collected to date be reviewed to ensure that they are suitable for the above purposes, should the need arise in the future.

8. CONCLUSIONS and RECOMMENDATIONS

1. The highest monthly dust deposition results in 2009 – 2010 were significantly influenced by huge regional dust events which swept across eastern Australia.

2. Care must be exercised in attempting to relate dust deposition results to potential dust sources. The contributing source, or sources, to an elevated result may be difficult to determine.

3. A number of gauges in the OEMP network are poorly located for the purpose of identifying impacts from KVAR2 and as such the OEMP dust gauge monitoring network should be reviewed.

4. The two, as yet to be installed, OEMP dust gauges in the residential area to the immediate west of KVAR2 will be of more relevance and use in identifying KVAR2 impacts than the more distant gauges, such as 27 and 28, and should be installed as soon as possible.

5. Consideration could be given to installing directional dust gauges, as well as standard dust gauges, to provide additional information regarding potential dust sources.

6. The dust gauge data from the first year of KVAR2 operations do not indicate that KVAR2 operations have resulted in dust deposition above the OEMP levels that trigger the requirement to implement additional control measures.

7. The OEMP requirement that: *If the 4 g/m^2/month limit is exceeded by more than 2 g/m^2/month a review of the effectiveness of the dust suppression regime and further mitigation measures shall be undertaken*, should be amended to require an assessment of the likely contribution of KVAR2 operations to the dust deposition levels prior to undertaking a review of the control measures.

8. No complaints regarding dust emissions from KVAR2 were received by either Delta Electricity or BBS during the first year of KVAR2 operations.

9. It is not possible with the data available to make any comment regarding the OEMP objective of *zero visible dust events in vicinity of KVAR2 operations*, although the camera installed at KVAR2 might be used in the future to assess performance against this objective.

10. Qualitative visual observations of collected dust samples provide support for the proposition that dust emissions from KVAR2 did not contribute adversely to measured deposition results in 2009 – 2010. Further support for this conclusion could be provided by the use of microscopic examination of a number of collected samples.

11. Interpretation of the dust gauge data might also be assisted by the installation of an anemometer at KVAR2.

12. The installation of a camera provides an excellent addition to the KVAR2 monitoring network and the images could be very useful in assessing potential impacts from KVAR2. It is suggested that the images collected to date be reviewed to ensure that they are suitable for the above purposes, should the need arise in the future.

9. REFERENCES

DEC (2005) Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, Department of Environment and Conservation, ISBN 1 74137 488 X, Sydney

DustWatch website http://www.environment.nsw.gov.au/dustwatch/dwreports.htm

Parsons Brinckerhoff (2009) Kerosene Vale Stage 2 Ash Repository Operation Environmental Management Plan. Prepared for Delta Electricity.

10. APPENDIX 1: THE AIR QUALITY MANAGEMENT PLAN

Prepared by Parsons Brinckerhoff for Delta Electricity.

Relevant aspect/impact	Management and mitigation measures	Source of requirement	Frequency	Relevant records	Responsibility
General requirements	▪ Stage 2 operations shall be conducted in a manner that minimises dust impacts generated by operational activities including wind-blown and traffic-generated dust. All activities on the site shall be undertaken with the objective of preventing visible emissions of dust from the site. Should such visible dust emissions occur at any time, practicable dust mitigation measures shall be identified and implemented, including cessation of relevant works, as appropriate, such that emissions of visible dust cease.	CoA 2.33	Ongoing	Site inspection checklist	Contractor
Ash haulage and placement	▪ Moisture levels in the ash remain shall be maintained at 15-20% until the material is placed in the repository area.	OEMP	Daily	Site inspection checklist	Contractor
	▪ All ash haulage trucks shall be fitted with remotely operated covers to completely cover the load whilst in transit between the ash silos and the repository. The load must be covered at all times except when loading or unloading ash material.	CoA 2.34	Daily	Site inspection checklist	Contractor
	▪ All ash haulage trucks shall go through the wheel and undercarriage washers prior to leaving the ash repository site and entering the private haul road.	OEMP	Daily	Site inspection checklist	Contractor
	▪ Temporary PVA, lignosulphate or tar capping shall be applied to seal ash faces, where ash is not currently being deposited, and where irrigation systems are not in operation and there is a probability of visible dust emissions occurring due to meteorological conditions.	OEMP	As required	Site inspection checklist	Contractor
	▪ A routine maintenance, inspection and cleaning regime shall be implemented for the two truck washes and adjacent washout/surface drainage pits within the repository site.	OEMP	As required	Site inspection checklist	Contractor

Relevant aspect/impact	Management and mitigation measures	Source of requirement	Frequency	Relevant records	Responsibility
Ash haulage and placement	▪ The private haulage roads shall be maintained in a clean condition by routinely washing the surface. This applies to the haul roads within the repository zone and does not include the private haul road from the power station. Particular attention must be paid during wet periods when muddy water is drawn from the repository area and deposited on the haul roads.	OEMP	As required	Site inspection checklist	Contractor
Dust controls	▪ A water cart shall be used to undertake dust suppression activities throughout the repository site, as required.	OEMP	As required	Site inspection checklist	Contractor
	▪ A dedicated water sprinkler and surface irrigation system shall be installed to cover the active ash placement area. The system will be in place prior to the commencement of ash placement activities and will be operated for the entire daily operating period or when 15 minute wind speed thresholds exceed 5 metres per second.	OEMP	As required	Site inspection checklist	Contractor
	▪ Note: Application rates and the coverage area shall have the capacity to ensure that no visible emissions from the repository area occur.				
	▪ In the event of visible dust emissions from the repository area, personnel shall notify the Site Manager or Repository Team Leader immediately, who will immediately direct the water cart operator to spray the area and review the location and application rate of the sprinkler system.	OEMP	As required	Site inspection checklist	Contractor
Air quality monitoring	▪ A total of 7 deposition gauges shall be used to monitor dust emissions at the perimeter of the ash repository area, and at key locations adjacent to residential properties and Wallerawang Power Station. This includes the existing 5 dust deposition gauges and the installation of an additional 2 dust deposition gauges. Note: The positioning of the additional 2 gauges has been reviewed by specialist consultants based on a review of local weather patterns and the sensitivity of surrounding properties and will be subject to landowner approval. Refer to Figure 6-5 for further details.	OEMP	Establishment prior to commencement of operations. Monthly to contribute to baseline data and monthly thereafter to monitor operations	Air monitoring records	Delta Electricity Specialist consultant

Relevant aspect/impact	Management and mitigation measures	Source of requirement	Frequency	Relevant records	Responsibility
Air quality monitoring	▪ Samples shall be removed from the dust deposition gauges on a monthly basis by a NATA approved laboratory and assessed for compliance with the appropriate air quality criteria.	OEMP	Monthly	Air monitoring report	Delta Electricity Specialist consultant
	▪ The DECC amenity-based criteria for dust fallout is a maximum total dust deposition of 4 g/m²/month (annual). The Stage 2 operations shall aim to achieve compliance with this limit.	OEMP	Ongoing	Air monitoring records	Delta Electricity Contractor
Air quality monitoring	▪ If the 4 g/m²/month limit is exceeded by more than 2 g/m², a review of the effectiveness of the dust suppression regime and further mitigation measures shall be undertaken, including: › increased application rates of the irrigation system at the ash working face › increased application rates of water on haul roads, particularly during high wind events › further reduction in the ash face working area below 1.5 hectares › increased implementation of temporary capping such as PVA, lignosulphate or tar where un-worked ash faces still exist › the application of higher ash moisture rates through the silo humidifier.	OEMP	Ongoing	Air monitoring records	Delta Electricity Contractor
Reporting	▪ Delta Electricity shall issue a report to the DECC every 12 months from commencement of operations. The report shall contain the location, frequency, rationale and the procedures and protocols for collecting air quality samples as well as the parameters analysed and methods of analysis.	CoA 7.3	Annually from commencement of operations	Report to DECC	Delta Electricity Specialist Consultant

Relevant aspect/impact	Management and mitigation measures	Source of requirement	Frequency	Relevant records	Responsibility
Reporting	▪ The results and analysis of the monitoring data shall also be included and assessed against the air quality criteria (4 g/m²/month) and the baseline data provided in Table D of Appendix C. In the case of exceedances; the response taken must be documented within the report. Any deviations from the proposed monitoring program must also be justified.	CoA 7.3	Annually from commencement of operations	Report to DECC	Delta Electricity Specialist Consultant
	▪ The Annual Environmental Management Report will be submitted to the Director-General complete with air quality monitoring data gathered throughout the year	CoA 7.3	Annually	Annual Environmental Management Report	Delta Electricity

11. APPENDIX 2: The REGIONAL DUST GAUGE NETWORK