aurecon

Project: Kerosene Vale Ash Repository Stage 2

Ongoing operational noise measurements

Prepared for: Delta Electricity

Project: 226131

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Contents

Appendices

Index of Figures

Index of Tables

1. Introduction

Aurecon was engaged by Delta Electricity to carry out ongoing operational noise monitoring for the Kerosene Vale Stage 2 Ash Repository (KVAR) located in Wallerawang, NSW. The noise measurements were carried out on Sunday 29th April and Monday 30th April 2012, during the early morning and evening periods as per the requirements outlined in the KVAR Stage 2 Operations, Operational Noise and Vibration Management Plan (ONVMP).

1.1 Site details

The project site consists of an Ash Repository which services the nearby Wallerawang Power Station (WPS). The major noise emissions associated with the Stage 2 KVAR works are:

- Unloading of ash from trucks at the repository.
- Placement and handling of ash at the repository site.
- Operation of trucks on the private haul road; trucks leave WPS loaded with ash (travelling north) and return from the repository empty (travelling south)

Figure 1 shows the site layout and location of sensitive receivers relative to the major noise sources including WPS as well as major roads in the area. Table 1 outlines the most affected sensitive receivers and their distance to the haul road.

Table 1: Representative noise measurement locations

Representative sensitive receiver	Distance (m) to haulage road*
60 Skelly Road	330
10 Skelly Road	240
21 Neubeck Street	160

Note * - distance relates to the property boundary or a point 30 m from the dwelling location

It should be noted that coal supply trucks also utilise the private haul road. Their noise impacts are not considered to be part of the Stage 2 KVAR works and thus their noise impact is outside the scope of this report. On site it is extremely difficult to visually distinguish between coal supply trucks and ash trucks. Therefore, for the purpose of prediction of noise emissions from ash trucks alone, Kerosene Vale have provided truck movement numbers during the assessment periods.

Figure 1: Site details

2. Noise criteria

The applicable operational noise criteria are outlined in the Project Approval, Application No. 07_0005. The criteria are summarised in condition 2.15 as follows:

> *2.15 The cumulative operational noise from the ash placement area and ash haulage activity shall not exceed a* $L_{Aeq\ (15\ minute)}$ ***of 40 dBA*** *at the nearest most affected sensitive receiver during normal operating hours as defined in condition 2.8.*
>
> *This criterion applies under the following meteorological conditions:*
>
> *a) Wind speeds up to 3 m/s at 10 meters above ground; and/or*
> *b) Temperature inversion conditions of op to 3°C/100 m and source to receiver gradient winds of up to 2 m/s at 10 m above ground level*

Normal operating hours in accordance with Conditions 2.8 are 7:00 am to 10:00 pm Monday to Sunday.

3. Noise measurements

3.1 Measurement methodology

Two types of measurements were carried out at the site: ambient noise and sound exposure levels. The measurements were carried out on Sunday 29 April and Monday 30 April 2012, during the early morning and evening periods, when the noise impacts are likely to be the most significant.

The ambient compliance noise measurements were conducted using a Larson Davis 831 Type 1 sound level meter which was set to 'A' frequency weighting, 'F' time weighting, and was fitted with an approved windshield. Measurements were typically taken at a height of 1.2 metres and at least 3.5 metre from any reflecting structure other than the ground. The measurement period at each location consisted of 15 minutes. A Larson Davis CAL200 was utilised to calibrate all sound level meters before and after each series of measurements with no significant calibration drift noted. The weather during the noise logging ranged from overcast to sunny condition, and wind speeds less than 5m/s at ground level. Measurements were typically taken in accordance with the Australian Standard *AS 1055 1997: Acoustics – Description and measurement of environmental noise*.

No meteorological measurements were taken during the noise survey to establish stability conditions or wind speeds at 10 metres above ground level.

The Sound Exposure Level (SEL) measurements were also carried out using a Larson Davis 831 Type 1 sound level meter which was set to 'A' frequency weighting, 'F' time weighting, and was fitted with an approved windshield. SEL is the equivalent one second A-weighted sound level which would produce the same sound energy as the actual event. The measurement was commenced when the truck was observed to pass a consistent location and stopped when the end of the truck passed a second consistent location. The reference locations were identified where the truck could be visually observed.

During both types of measurements no rain periods were experienced. Minimal wind was induced on the microphone with any light breeze periods being significantly below the 5 m/s threshold.

3.2 Measurement locations

The measurement locations were chosen to represent the three most affected sensitive receivers as outlined in the Operational Noise and Vibration Management Plan (ONVMP). The three most affected receivers prior to commencement of the measurements were identified based on the information in the Stage 2 Kerosene Vale Ash Repository operational noise review.

Due to the increased background noise level at each of the three noise monitoring locations it was difficult to assess individual truck noise events (Section 4). A fourth noise monitoring location was selected closer to the haulage route to measure individual truck pass-by events. Table 2 and Figure 2 outline the noise measurement locations.

Table 2: Representative noise measurement locations

Measurement location	Measurement distance (m) to haulage road	Representative sensitive receiver
A	300	60 Skelly Road
B	270	10 Skelly Road
C	160	21 Neubeck Street
D	95	-

Figure 2: Noise measurement locations

General observation regarding ambient noise environment as well as the truck movements and ash repository operations are described as follows. Individual truck noise varied significantly between trucks. The noise emissions were dependant on the speed travelled, driving technique and direction of travel. The variances were apparent even between the same types of vehicles. Truck pass-by numbers were higher during the morning period on both measurement days when compared to the evening truck counts. Operational noise from the Ash Repository was typically inaudible at the noise sensitive receiver locations during all the attended noise measurements.

The noise levels at all locations were affected by other ambient noise sources such as bird/insects life, domestic animals, passenger and freight train horn, domestic noise, extraneous noise from nearby construction site, background noise from the Wallerawang Power Station as well as intermittent traffic noise from nearby Castlereagh Highway and Wolgan Road. Due to high background noise from the activities mentioned above, truck engine noise was sometimes masked and was not clearly audible.

3.2.1 Location A (60 Skelly Road)

The background noise contributions at Location A were predominantly from the hum from Delta Electricity Wallerawang Power Station and traffic noise from Castlereagh highway. Faint traffic noise from Wolgan Road was also audible. The haulage road was clearly visible from this measuring location and the trucks moving on the haulage road could be easily identified except during the 07:42 measurement on 30/04/2012 where the visibility was slightly poor due to fog. The horn from the passenger/freight/coal train was clearly audible at this location for one instance during the entire measurement. There was audible noise of reversing alarm and heavy impact bangs from unloading during the 30/04/2012 - 07:42 measurement. After investigation is was apparent that these noises were originating from a nearby residential property adjacent to Wolgan Road, where some temporary construction work was underway and an excavator was working on site. Noise from birds and insects also contributed to the background noise at this location. The background noise level (LA90) was observed to be approximately 3 – 5 dBA higher specifically during the Monday morning measurement (50dBA) compared to 29/04/2012 and 30/04/2012 - 20:34 measurements (45 – 47 dBA). This increase in noise levels was determined to be essentially due to the additional contribution from Delta Power Station.

3.2.2 Location B (10 Skelly Road)

The background noise contributions at Location B were predominantly from the hum from Delta Electricity Wallerawang Power Station and noise from birds/ insects/ animals. Traffic noise from Wolgan Road was clearly audible at this location. The haulage road was clearly visible from this measuring location and the trucks moving on the haulage road could be easily identified except during the morning period measurement on 30/05/2012 where the visibility was poor due to extensive fog obstructing the vision. Noise of reversing alarms and impact bangs from the excavator working inside the residential property adjacent Wolgan Road was also audible at this location during the 30/04/2012 – 07:22 measurement. The background noise level (LA90) was observed to be approximately 6 – 9 dBA higher specifically during the Monday morning measurement (44dBA) compared to Sunday and Monday evening measurements (35 – 38) essentially due to the additional contribution from Delta Power Station.

3.2.3 Location C (21 Neubeck Street)

The background noise contributions at Location C were predominantly from the hum from Delta Electricity Wallerawang Power Station and noise from birds/insects/animals. Traffic noise from Wolgan Road was clearly audible and substantially contributed to the ambient noise levels. There was temporary noise from construction activities (including bucket bangs from excavator, engine idle noise, track slaps, loading and unloading, reversing alarm, etc) at the Lot 21, Neubeck Street during the 30/04/2012 – 06:59 measurement which pushed the background noise levels (L90) to 50 dBA. It has been confirmed by the client that these activities were not part of Kerosene Vale Ash Repository operations. Delta Electricity Power Station hum was clearly audible during the entire measurement at all locations. The trucks moving on the haulage road were not visible from this location because of an earth mound blocking the line of sight, although the trucks were clearly audible.

3.2.4 Location D

The noise data collected at Location D measured the Sound Exposure Levels (SEL) of individual truck pass-by events on 7/11/2011. At this closer location to the truck haulage road, each truck pass-by was clearly audible above other ambient noise sources.

3.3 Operating and meteorological conditions

Delta Electricity has provided the following information regarding the operations during the noise survey.

- The ash silos normally operate at approximately 83 – 85% capacity.
- Trucks were operating during all measurement periods moving from north to south and visa-versa on the haulage road east of Skelly Road. The number of trucks pass by varied from a maximum of 12 trucks (including north bound and south bound trucks during 29/04/2012 – 08:12 measurement at Location A) to minimum of 1 truck (including north bound and south bound trucks during 29/04/2012 – 18:53 measurement at Location B). The number of trucks counted during the measurement period included ash and coal trucks. Trucks were operating at a constant rate, with approximate 15-30 minute circuits for each truck from 7am – 10pm daily.

The meteorological conditions during the noise survey based on 5 minute data from the Mount Piper weather station are shown in Table 3. The weather station details are as follows:

- Location – South: 33° 21’ 46.0”, East: 150° 01’ 21.0”
- Elevation – 956 m
- Anemometer height – 10 m above ground level

Table 3: Meteorological conditions during noise survey

Time and date	Rainfall (mm)	Wind Speed (m/s)	Wind Direction (deg)	Relative Humidity (%)	Temp (°C)	Atmospheric Stability
29/04/2012 7:20	0.0	1.9	187	84	7.6	B
29/04/2012 7:25	0.0	1.3	185	82	8.0	B
29/04/2012 7:30	0.0	1.3	191	80	8.5	A
29/04/2012 7:35	0.0	1.3	193	79	8.9	B
29/04/2012 7:40	0.0	1.3	205	78	9.1	B
29/04/2012 7:45	0.0	1.1	193	76	9.5	A
29/04/2012 7:50	0.0	1.0	180	75	10.1	A
29/04/2012 7:55	0.0	0.3	177	74	10.6	A
29/04/2012 8:00	0.0	1.1	170	71	11.1	A
29/04/2012 8:05	0.0	1.6	160	69	11.3	B
29/04/2012 8:10	0.0	1.1	153	69	11.0	A
29/04/2012 8:15	0.0	1.4	193	70	11.1	A
29/04/2012 8:20	0.0	2.0	182	68	11.3	A
29/04/2012 8:25	0.0	1.8	182	68	11.3	B
29/04/2012 8:30	0.0	0.9	170	68	11.6	A
29/04/2012 18:30	0.0	1.8	138	86	8.7	C
29/04/2012 18:35	0.0	1.1	150	86	8.6	B
29/04/2012 18:40	0.0	0.9	181	86	8.6	A

Time and date	Rainfall (mm)	Wind Speed (m/s)	Wind Direction (deg)	Relative Humidity (%)	Temp (°C)	Atmospheric Stability
29/04/2012 18:45	0.0	0.6	164	86	8.5	A
29/04/2012 18:50	0.0	0.4	330	86	8.4	A
29/04/2012 18:55	0.0	0.6	189	87	8.3	A
29/04/2012 19:00	0.0	0.0	315	88	8.3	A
29/04/2012 19:05	0.0	0.9	183	88	8.2	A
29/04/2012 19:10	0.0	0.6	214	88	8.1	A
29/04/2012 19:15	0.0	0.6	252	89	8.0	A
29/04/2012 19:20	0.0	1.0	151	89	7.8	A
29/04/2012 19:25	0.0	1.3	148	89	7.8	C
29/04/2012 19:30	0.0	0.7	176	90	7.9	A
29/04/2012 19:35	0.0	0.4	171	90	7.9	A
29/04/2012 19:40	0.0	0.4	125	90	7.9	A
30/04/2012 6:55	0.0	0.9	280	99	3.8	C
30/04/2012 7:00	0.0	1.0	278	100	4.1	D
30/04/2012 7:05	0.0	1.0	271	100	4.2	C
30/04/2012 7:10	0.0	0.5	354	99	4.1	A
30/04/2012 7:15	0.0	0.8	15	99	3.9	D
30/04/2012 7:20	0.0	0.9	26	101	4.4	D
30/04/2012 7:25	0.0	0.8	28	101	5.0	D
30/04/2012 7:30	0.0	0.5	1	102	5.6	A
30/04/2012 7:35	0.0	0.1	304	102	6.1	A
30/04/2012 7:40	0.0	0.4	216	102	6.7	A
30/04/2012 7:45	0.0	1.1	220	102	6.9	C
30/04/2012 7:50	0.0	1.4	213	101	7.1	D
30/04/2012 7:55	0.0	1.2	232	100	7.1	D
30/04/2012 8:00	0.0	1.0	236	97	7.0	C
30/04/2012 19:55	0.0	1.7	49	87	9.2	A
30/04/2012 20:00	0.0	1.5	42	87	9.1	A
30/04/2012 20:05	0.0	1.3	54	88	9.2	A
30/04/2012 20:10	0.0	1.1	37	88	9.3	A
30/04/2012 20:15	0.0	1.3	32	88	9.3	A
30/04/2012 20:20	0.0	1.4	41	89	9.3	A
30/04/2012 20:25	0.0	1.2	19	89	9.3	A
30/04/2012 20:30	0.0	0.9	87	89	9.3	A
30/04/2012 20:35	0.0	0.9	79	89	9.3	A
30/04/2012 20:40	0.0	1.4	36	89	9.3	A
30/04/2012 20:45	0.0	1.4	49	89	9.4	B
30/04/2012 20:50	0.0	1.3	40	89	9.4	A
30/04/2012 20:55	0.0	1.3	37	89	9.3	A
30/04/2012 21:00	0.0	2.3	32	89	9.3	B
30/04/2012 21:05	0.0	1.9	13	89	9.2	C
30/04/2012 21:10	0.0	1.9	360	89	9.2	D
30/04/2012 21:15	0.0	2.2	12	90	9.1	D
30/04/2012 21:20	0.0	2.2	28	90	9.0	D
30/04/2012 21:25	0.0	2.5	30	90	9.1	C

Time and date	Rainfall (mm)	Wind Speed (m/s)	Wind Direction (deg)	Relative Humidity (%)	Temp (°C)	Atmospheric Stability
30/04/2012 21:30	0.0	1.9	23	90	9.1	B
30/04/2012 21:35	0.0	2.1	17	90	9.1	C
30/04/2012 21:40	0.0	2.0	31	90	9.0	B
30/04/2012 21:45	0.0	2.3	26	91	9.0	C
30/04/2012 21:50	0.0	2.3	21	91	9.0	C

Note *: Atmospheric stability class is determined using Sigma Theta data (not shown) and applying the Pasquill method. Pasquill-Gifford stability classes range from: A being highly Unstable, D neutral and G extremely stable.

As can be observed from the above meteorological data, the wind speeds were predominately low during the noise survey, with atmospheric stability ranging from unstable to neutral.

3.4 Results

3.4.1 Ambient noise measurements

The results from the 15 minute ambient noise measurements at each of the measurement locations are shown in Table 4.

Table 4: Noise measurement results (15 minute)

Location	Date	Time	Sound pressure level (dBA)				Number of truck Pass-bys and direction of travel*		
			L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	North	South	Total
C	29/04/2012	07:26	47	69	52	40	7	4	11
B	29/04/2012	07:48	49	69	49	35	8	3	11
A	29/04/2012	08:12	44	65	47	40	8	4	12
C	29/04/2012	18:29	39	62	40	36	1	2	3
B	29/04/2012	18:53	46	66	49	36	0	1	1
A	29/04/2012	19:21	43	60	44	42	1	2	3
C	30/04/2012	06:59	51	65	52	50	0	2	2
B	30/04/2012	07:22	47	56	50	44	4	2	6
A	30/04/2012	07:42	48	70	50	45	5	5	10
C	30/04/2012	19:55	39	53	41	35	4	2	6
B	30/04/2012	20:15	41	60	44	38	3	2	5
A	30/04/2012	20:34	43	55	45	41	3	3	6

Note * - truck counts include both coal and ash trucks

The measured $L_{Aeq\ (15\ min)}$ is generally in excess of the assessment criteria of $L_{Aeq\ (15\ min)}$ of 40 dBA. The high noise levels are mainly associated with local noise events such bird noise and traffic noise levels from surrounding roads as well as some truck pass-bys along the haulage route. The high background noise level is predominantly associated with the operation of the Wallerawang Delta Electricity Power Station.

3.4.2 SEL measurements

The individual truck pass-by noise event measurements at Location D are summarised in Table 5 which were conducted on 7th November 2011.

Table 5: SEL noise measurement results at Location D

Truck travelling direction	Average event time (s)	Average SEL (dBA)	No. of valid truck event measurements
South	28.9	68	8
North	18.1	70	9

4. Data analysis

As can be observed from the results presented in Table 4, the existing ambient noise levels $L_{Aeq\ (15\ min)}$ are predominantly in excess of the assessment criteria of $L_{Aeq\ (15\ min)}$ of 40 dBA. The background noise (LA90) from the various noise sources exceeded the noise criteria of 40dBA during most of the measurements. Noise contribution from the ash repository activities was masked by high background noise mainly from Delta Electricity Power Station. This signifies that noise emissions from the truck movements and ash repository cannot be assessed independently based on ambient noise measurements.

To assess the impact of the ash truck noise emissions, the influence of individual truck pass-by noise events have to be taken into account. Based on the SEL measurement results (shown in Table 5) and the number of truck movements provided by the Kerosene Vale Ash Repository, an $L_{Aeq\ (15\ min)}$ noise level was predicted, which takes into account the total number of truck pass-bys (only ash trucks), distance of noise source from the receiver and any potential barrier effects. These predictions are shown in Table 6 below. As per the information provided by the Kerosene Vale Ash Repository, there were 2 trucks moving on the haulage road at a frequency of 8 trips north to south and 8 trips south to north per hour from 07:00 to 22:00 during 29th and 30th April 2012. Based on the information provided above 4 truck movement (2 north bound and 2 south bound) per 15 minutes have been considered for calculating the contribution from ash trucks on the nearest sensitive receivers.

The noise emissions from the ash repository are considered to be below the assessment criteria as they were predominantly inaudible during the noise survey and could not be distinguished.

Table 6: Noise predictions from truck movements based on SEL measurements

Sensitive receiver	Distance to haulage road (m)	No. of average truck movements per 15min	Predicted $L_{Aeq\ (15\ min)}$ (dBA)	Criteria $L_{Aeq\ (15\ min)}$ (dBA
60 Skelly Road	330	4, (2 N, 2 S)	35	40
10 Skelly Road	240	4, (2 N, 2 S)	38	40
21 Neubeck Street	160	4, (2 N, 2 S)	36*	40

Note * - includes barrier attenuation from earth mound of approximately 5 dBA

It can be seen from the above result that the predicted $L_{Aeq\ (15\ min)}$ noise emissions based on the SEL measurements satisfy the required assessment criteria. Therefore the operational noise emissions from the Stage 2 KVAR are considered compliant to the Conditions of Approval.

5. Conclusion

Aurecon conducted ongoing operational noise monitoring for the Kerosene Vale Stage 2 Ash Repository (KVAR) located in Wallerawang, NSW. The noise measurements were carried out at the three most affected sensitive receiver locations on Sunday 29 April and Monday 30 April 2012. The assessment criteria are outlined in the Project Approval, Application No. 07_0005, with the criteria consisting of $L_{Aeq\ (15\ minute)}$ of 40 dBA from all ash haulage and placement associated operational noise emissions at the nearest sensitive receivers.

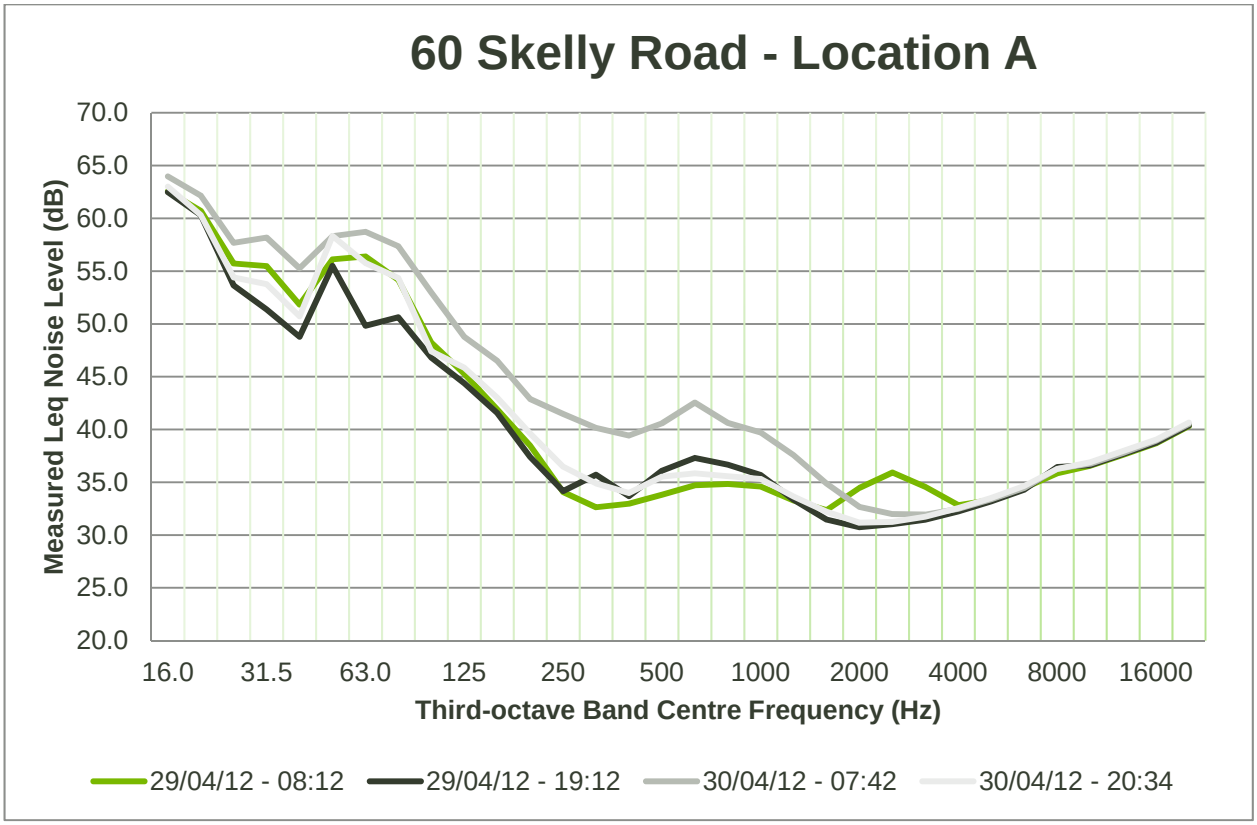
The primary contributors to the background and ambient noise levels at all the locations were from the traffic noise and hum from Delta Electricity Power Station. The noise contribution from KVAR Stage 2 activities alone could not be determined based on ambient noise measurements due to contamination from other ambient noises. Additional Sound Exposure Level measurements of individual truck pass-by events at a closer distance to the truck haulage road were carried out during the November 2011 noise monitoring. Based on the previous SEL measurement results and observations of truck movements on site, a $L_{Aeq\ (15\ min)}$ noise level was predicted at each of the assessment sensitive noise receivers. The predicted noise levels took into account only ash trucks movement associated with Stage 2 KVAR works, distance of the noise source from the receivers and potential noise barrier effect. The predicted noise level at each of the noise receivers showed compliance with assessment criteria, thus the operational noise emissions from the Stage 2 KVAR are considered compliant with the Conditions of Approval.

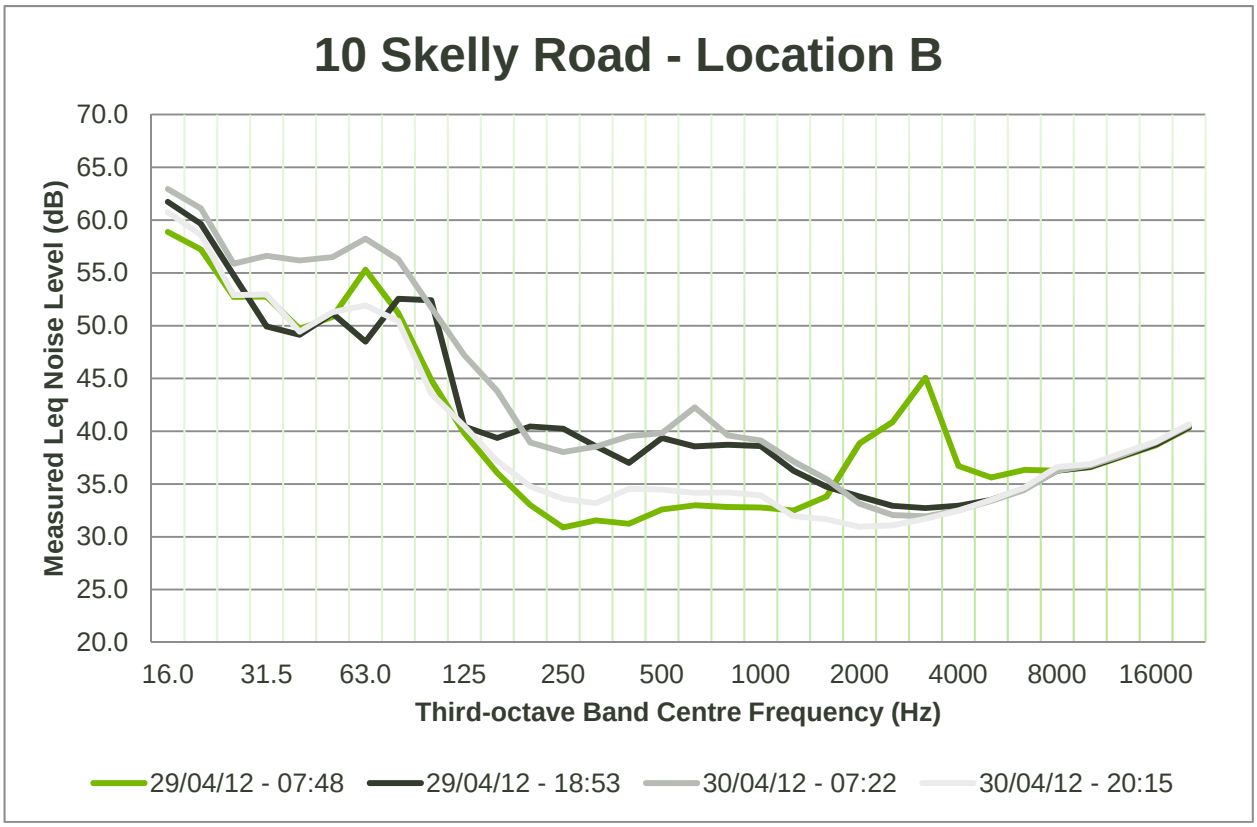
6. References

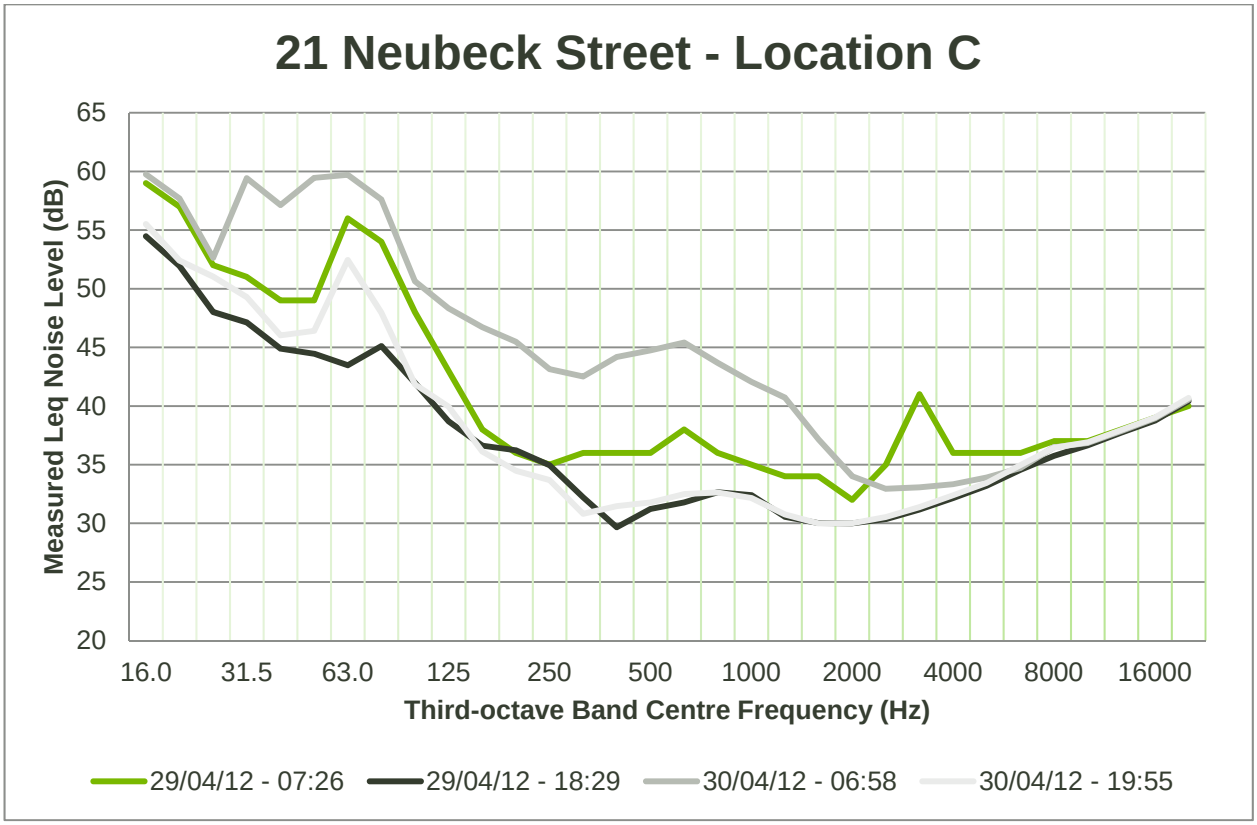
- Kerosene Vale Stage 2 Ash Repository, Operational Environmental Management Plan (OEMP), Parsons Brinckerhoff, April 2009, which includes:
  - Appendix A: KVAR Stage 2 Operations, Operational Noise and Vibration Management Plan (ONVMP), Parsons Brinckerhoff, April 2009
- Project Approval (PA), Application: No 07_0005, Delta Electricity, 26 November 2008, Department of Planning
- Stage 2 Kerosene Vale Ash Repository operational noise review, Parsons Brinckerhoff, September 2009

Appendix A

Noise measurement graphs


60 Skelly Road - Location A
Measured Leq Noise Level (dB)
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
16.0
31.5
63.0
125
250
500
1000
2000
4000
8000
16000
Third-octave Band Centre Frequency (Hz)
29/04/12 - 08:12
29/04/12 - 19:12
30/04/12 - 07:42
30/04/12 - 20:34


10 Skelly Road - Location B
Measured Leq Noise Level (dB)
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
16.0
31.5
63.0
125
250
500
1000
2000
4000
8000
16000
Third-octave Band Centre Frequency (Hz)
29/04/12 - 07:48
29/04/12 - 18:53
30/04/12 - 07:22
30/04/12 - 20:15


21 Neubeck Street - Location C
Measured Leq Noise Level (dB)
65
60
55
50
45
40
35
30
25
20
16.0
31.5
63.0
125
250
500
1000
2000
4000
8000
16000
Third-octave Band Centre Frequency (Hz)
29/04/12 - 07:26
29/04/12 - 18:29
30/04/12 - 06:58
30/04/12 - 19:55

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