aurecon

Project: Kerosene Vale Ash repository Stage 2

Ongoing operational noise measurements (Feb 2017)

Prepared for:
EnergyAustralia NSW

Project: 247023

10 April 2017

Document control record

Document prepared by:

Aurecon Australasia Pty Ltd

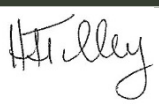
ABN 54 005 139 873

Level 5, 116 Military Road
Neutral Bay NSW 2089

PO Box 538
Neutral Bay NSW 2089
Australia

T +61 2 9465 5599
F +61 2 9465 5598
E sydney@aurecongroup.com
W aurecongroup.com

Document control						
Report Title	Ongoing operational noise measurements (Feb 2017)					
Document ID	247023-KV-REP-10-REV1		**Project Number**		247023	
File Path	\\Aurecon.info\Shares\AUSYD\Projects\BG\247023\3.Project Delivery\12.Deliverables\Acoustics\170317_Feb 2017 Survey\Report\KVAR Compliance Noise Feb 2017 rev2.docx					
Client	EnergyAustralia NSW		**Client Contact**		Coleen Milroy	
Rev	**Date**	**Revision Details/Status**	**Prepared by**	**Author**	**Verifier**	**Approver**
1	7 April 2017	Initial Draft	AL	AL	BD	HT
2	10 April 2017	Final issue	AL	AL	BD	HT
Current Revision	**2**					

Approval			
Author Signature		Approver Signature	
Name	Akil Lau	Name	Heather Tilley
Title	Acoustic Consultant	Title	Environmental Consultant

Contents

Appendices

Figures

Tables

1 Introduction

Aurecon was engaged by EnergyAustralia NSW to carry out ongoing operational noise monitoring for the Kerosene Vale Stage 2 Ash Repository (KVAR) located in Wallerawang, NSW in accordance with Project Approval Application No. 07_0005. The noise measurements were carried out on Sunday 12 March 2017 and Monday 13 March 2017, during the early morning and evening periods as per the requirements outlined in the KVAR Stage 2 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). During normal operation of the KVAR Stage 2, the following major noise emissions would be expected.

- Unloading of ash from trucks at the repository.
- Placement and handling of ash at the repository site.
- Operation of trucks on the private haulage road; this includes trucks leaving WPS loaded with ash (travelling north) and returning from the repository empty (travelling south).
- Water pumps operating at the repository.
- Water cart driving around.

However, the site is no longer fully operational and no noise emissions from the location of the KVAR was evident during the current site visit.

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

Table 1: Representative sensitive receivers

Representative sensitive receiver	Distance to haulage road (meters)*
60 Skelly Road	300
10 Skelly Road	270
21 Neubeck Street	145

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 haulage 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. While undertaking noise measurements 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, EnergyAustralia NSW provides the number of truck movements for the periods of measurement.

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 dB(A)*** *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[1]; and/or*
> *b) Temperature inversion conditions of up 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 during the current monitoring period:

- Ambient noise measurements and
- Sound exposure level measurements.

The measurements were carried out on Sunday 12 March 2017 and Monday 13 March 2017, during the early morning and evening periods, when the noise impacts are likely to be the most significant.

Ambient noise measurements

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 metres from any reflecting structure other than the ground.

Measurements were undertaken for a period of 15 minutes at each of the selected measurement locations (See Table 2). A Larson Davis CAL200 was utilised to calibrate the sound level meters before and after each series of measurements. No significant calibration drift was noted.

The weather during the ambient noise logging ranged from overcast to sunny conditions, and wind speeds were less than 3 m/s at ground level. Measurements were generally taken in accordance with the Australian Standard *AS 1055 1997: Acoustics – Description and measurement of environmental noise*.

Sound exposure level (SEL) measurements

The Sound Exposure Level (SEL) measurements were also carried out using the Larson Davis 831 Type 1 sound level meter. SEL is the equivalent one second A-weighted sound level which produces the same sound energy as an actual identified event. The SEL measurement was commenced when a

[1] As per AS 1055.1 – 1997, noise measurements should be avoided when maximum windspeed exceed 5 m/s at the microphone position.

truck/ light vehicle was observed to pass a nominated reference location and stopped when the end of the truck passed a second nominated reference location. The nominated reference locations were identified where the truck could be visually observed.

3.2 Measurement locations

The measurement locations were chosen to represent the three most affected sensitive receivers as outlined in the ONVMP and shown in Table 1. These three receivers were identified based on the information in the Stage 2 Kerosene Vale Ash Repository operational noise review.

Due to the high background noise levels at each of the three monitoring locations it was difficult to assess individual truck noise events. A fourth noise monitoring location identified as Location D and shown in Appendix C, 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 to haulage road (meters)	Representative sensitive receiver
A	300	60 Skelly Road
B	270	10 Skelly Road
C	145	21 Neubeck Street
D	80	-

Figure 2 | Noise measurement locations

3.3 Conditions during measurements

3.3.1 Operating conditions

EnergyAustralia NSW stated that no trucks were operating during any of the measurement periods.

3.3.2 Meteorological conditions

The meteorological conditions applicable to the noise survey period are based on meteorological data provided at 15 minute intervals from the Mt Piper weather station. This data is shown in Appendix D.

No rain periods were experienced during the attended noise monitoring events, however adverse wind conditions (wind speed higher than 5m/s at the microphone position)[2] were experienced on Sunday evening which impacted on the ambient noise measurements. These noise measurements were excluded from the noise measurement results summary.

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 3.

As discussed in Section 3.3.2, due to a change in weather and adverse wind conditions[2] on Sunday (12 March 2017) during the evening periods, the noise measurements during these monitoring events were excluded from the results for all three locations.

Table 3: Noise measurement results (15 minute)

Location	Date of measurement	Time	Measured sound pressure level dB(A)					Number of truck Pass-bys and direction of travel[1]		
			L_{Aeq}#	L_{Amax}*	L_{Amin}**	L_{A10}^^	L_{A90}^	North	South	Total
60 Skelly Road (A)	Sunday 12/03/2017	8:57	**47**	76	28	43	33	1	0	0
		N/A	**-**	-	-	-	-	0	0	0
	Monday 13/03/2017	10:13	38	63	26	37	29	0	0	0
		20:01	**43**	56	33	46	37	0	0	0
10 Skelly Road (B)	Sunday 12/03/2017	8:39	40	48	38	42	32	0	0	0
		N/A	**-**	-	-	-	-	0	0	0
	Monday 13/03/2017	9:57	**42**	70	25	41	29	0	0	0
		19:55	**47**	61	35	51	39	0	0	0
21 Neubeck Street (C)	Sunday 12/03/2017	8:20	**41**	66	27	42	31	0	0	0
		N/A	**-**	-	-	-	-	0	0	0
	Monday 13/03/2017	9:38	**40**	61	27	42	30	0	0	0
		19:37	**44**	61	34	47	37	0	0	0

Note : [1] - Truck counts include ash trucks and light commercial vehicles.

Exceedances of the $L_{Aeq\ (15\ min)}$ of 40 dB(A) are shown in Bold.

N/A[2] refers to adverse wind conditions during Sunday evening survey which is excluded

\# *L_{Aeq} refers to A-weighted equivalent continuous sound pressure level over measurement period. It is used to quantify the average noise level over a time period.*

* *L_{Amax} refers to the maximum A-weighted noise level detected during the measuring period. It refers to the maximum background noise detected.*

** *L_{Amin} refers to the minimum A-weighted noise level detected during the measuring period. It refers to the minimum background noise detected.*

^^ *L_{A10} refers to the A-weighted noise level which is exceeded for only 10% of the measuring period. It is usually used as the descriptor for intrusive noise level and represents ambient road traffic noise in general.*

[2] As per AS 1055.1 – 1997, noise measurements should be avoided when maximum windspeed exceed 5 m/s at the microphone position.

^ *L_{A90} refers to the A-weighted noise level which is exceeded for 90% of the measuring period. It is usually used as the descriptor for background noise level during the measurement period.*

The measured $L_{Aeq\ (15\ min)}$ exceeded the assessment criteria of $L_{Aeq\ (15\ min)}$ of 40 dB(A) during all but two of the attended noise monitoring events. As there were no truck movements (except one light commercial vehicle) associated with the operation of the KVAR during the attended noise monitoring event, it can be assumed that the KVAR operations did not contribute to the high background noise levels at any of the measurement locations and that the high noise levels are associated with local noise events such as traffic from surrounding roads and birds/insects.

3.4.2 SEL measurements

The individual truck pass-by noise event (SEL) measurements at Location D (approximately 80 meters from the haulage road) were conducted on 7 November 2011, 21 April 2013 and 31 March 2014. The results are summarised in Table 4. The number of actual truck pass-bys counted during the daytime survey are also summarised in Table 4. These data were used to predict the noise impact from the truck movement on the sensitive receivers.

Based on the visual site inspection, the grade (slope) of the haulage road rises from south to north. The trucks moving in the northerly direction on the haulage road appear to rev the engine more compared to the trucks moving in the opposite direction and thereby producing a marginally higher SEL as evident in the results summarised in Table 4.

Table 4: SEL noise measurement results at Location D

Date	Truck travelling direction	Average event duration (sec)	Average SEL dB(A)	No. of valid truck event measurements
7/11/2011	South	28.9	68	8
	North	18.1	70	9
21/04/2013	South	24.0	67	5
	North	19.5	70	7
31/04/2014	South	27.7	69	2
	North	28.3	70	2

4 Noise assessment

General observation regarding the ambient noise environment, as well as the truck movements and ash repository operations, during the attended noise measurements are described as follows.

- Operational noise from the KVAR site and the truck engine noise was inaudible at the sensitive receiver locations during the attended noise measurements and no ash trucks were visible on the haul road, but one light commercial vehicle was sighted on the haul road.
- The noise levels at all locations were affected by background noise sources such as bird/insects, domestic animals and domestic noise. Background noise at all sites was dominated by the intermittent traffic noise from nearby Castlereagh Highway and Wolgan Road.

General observations for the three monitoring locations are described below.

4.1 Location A (60 Skelly Road)

The background noise contributions at Location A were predominantly from the traffic noise from Castlereagh Highway and distant traffic. Faint and intermittent traffic noise from Wolgan Road was also audible.

The haulage road was clearly visible from this location, however no coal or ash trucks were visible on the haulage road during the attended noise monitoring period (except for 1 light commercial vehicle during Sunday morning period). Noise from birds and insects also contributed to the ambient noise at this location.

As shown in Table 3, the background noise varied over the two days with L_{A90} ranging from 29 dB(A) to 37 dB(A). The background noise (L_{A90}) during the attended noise measurements was predominantly due to road traffic on the Castlereagh Highway, Wolgan Road and other nearby roads.

4.2 Location B (10 Skelly Road)

Contributions to the background noise at Location B were predominantly from birds/insects/animals and traffic on Wolgan Road and Skelly Road.

Traffic noise from Wolgan Road and Skelly Road was clearly audible at this location. The haulage road was clearly visible from this measuring location, however no coal or ash truck were visible on haulage road during the attended noise monitoring period movement.

On Sunday and Monday morning, a faint hum (31.5 - 63 Hz) was audible and appeared to originate from the north westerly direction (towards Blackmans Flat). Background noise levels varied over the two days with L_{A90} ranging from 29 - 39 dB(A).

4.3 Location C (21 Neubeck Street)

Contributions to the background noise at Location C were predominantly from birds/insects/animals and distant traffic on Wolgan Road and other roads.

Dogs at the nearest residential property affected the ambient noise levels (due to intermittent barking) measured at this location. Traffic noise from Wolgan Road was clearly audible and also contributed to the ambient noise levels.

The haulage road was not clearly visible from this location because of an earth mound and heavy vegetation blocking the line of sight; however no truck engine noise was audible during the attended noise monitoring period.

Background noise varied over the two days with L_{A90} ranging from 30 – 37 dB(A).

4.4 Location D

The noise data collected at Location D (Figure 2 and Appendix C) measured the SEL of individual truck pass-by events on 7 November 2011, 22 April 2013 and 31 April 2014 (See Table 4).

This location is closest to the haulage road and as such, each truck pass-by was the dominant noise source (clearly audible above other ambient noise sources) during these monitoring events.

5 Analysis and recommendations

5.1 Data analysis

As can be observed from the summary of noise measurements presented above, the existing ambient noise levels $L_{Aeq\ (15\ min)}$ exceed the assessment criteria of $L_{Aeq\ (15\ min)}$ of 40 dB(A) on all but two of the monitoring events. This section deals with noise prediction based on the number of truck movements (worst case scenario) for any worst case 15 minute period.

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. $L_{Aeq\ (15\ min)}$ noise level was predicted based on the SEL measurement results (shown in Table 4) and the number of truck movements provided by EnergyAustralia NSW.

The predicted noise levels take into account the total number of truck pass-bys (including ash trucks and small commercial vehicles) and the distance of the noise source from the receiver. The assessment included the calculated barrier effect (- 2dB(A)) at Location C due to the earth mound located on the northern side of the site which blocks the line of sight between 21 Neubeck Street and the haulage road, therefore attenuating the noise from haulage road. Generally, trucks operate at a constant rate, with approximately 15-20 minute circuits for each truck. Table 5 provides a summary of truck pass-bys based on information collected during a previous site visit.

Table 5: Truck movement data

Periods	Information collected during site visit on 30-31 March 2014	
	Total number of trucks pass bys per 45 minutes	**Average number of trucks pass bys per 15 minutes**
Morning 30/03/2014	7	2.3
Evening 30/03/2014	2	0.7
Morning 31/03/2014	7	**2.3**[#]
Evening 31/03/2014	3	1.0

Note: the figure in **bold** is the worst-case truck movement (most frequent) used to predict the noise contribution from the truck movements (shown in Table 6)
Maximum number of truck pass-bys as per information collected during the site visit.

As shown in Table 5, the maximum number of truck pass-bys was during the morning period on both 30/03/2014 and 31/03/2014. The lowest truck pass-bys was during the evening period on 30/03/2014. The noise emissions from the KVAR are considered to be below the assessment criteria as they were predominantly inaudible during the noise survey and could not be distinguished.

Table 6 provides the noise predictions from haulage trucks alone at the nearest sensitive receivers based on SEL measurements. The prediction is calculated from the movement of ash trucks based on the worst case scenario (i.e. 2.3 truck pass-bys during any 15 minute period).

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	300	2.3	32	40
10 Skelly Road	270	2.3	33	40
21 Neubeck Street *	145	2.3	37*	40

Note * - Includes the calculated barrier attenuation (-2dBA) provided by the earth mound blocking direct line of sight between the residence and haulage road.

Based on the worst case scenario the noise impact from truck movements complies with noise criteria of $L_{Aeq\ (15\ min)}$ of 40 dB(A) at all the sensitive receiver locations.

There were no truck movements during this current noise monitoring event, therefore the operational noise emissions from the Stage 2 KVAR is considered to be compliant with Condition 2.15 of the Project Approval.

6 Conclusion

Aurecon conducted operational noise monitoring for the Stage 2 KVAR located in Wallerawang, NSW. The noise measurements were carried out at the three most affected sensitive receiver locations on Sunday 12 March 2017 and Monday 13 March 2017, in the early morning and evening in accordance with the KVAR Stage 2 ONVMP.

The applicable noise assessment criteria of $L_{Aeq\ (15\ minute)}$ of 40 dB(A) from all ash haulage and ash placement associated operational noise emissions at the nearest sensitive receivers is outlined in the Project Approval, Application No. 07_0005.

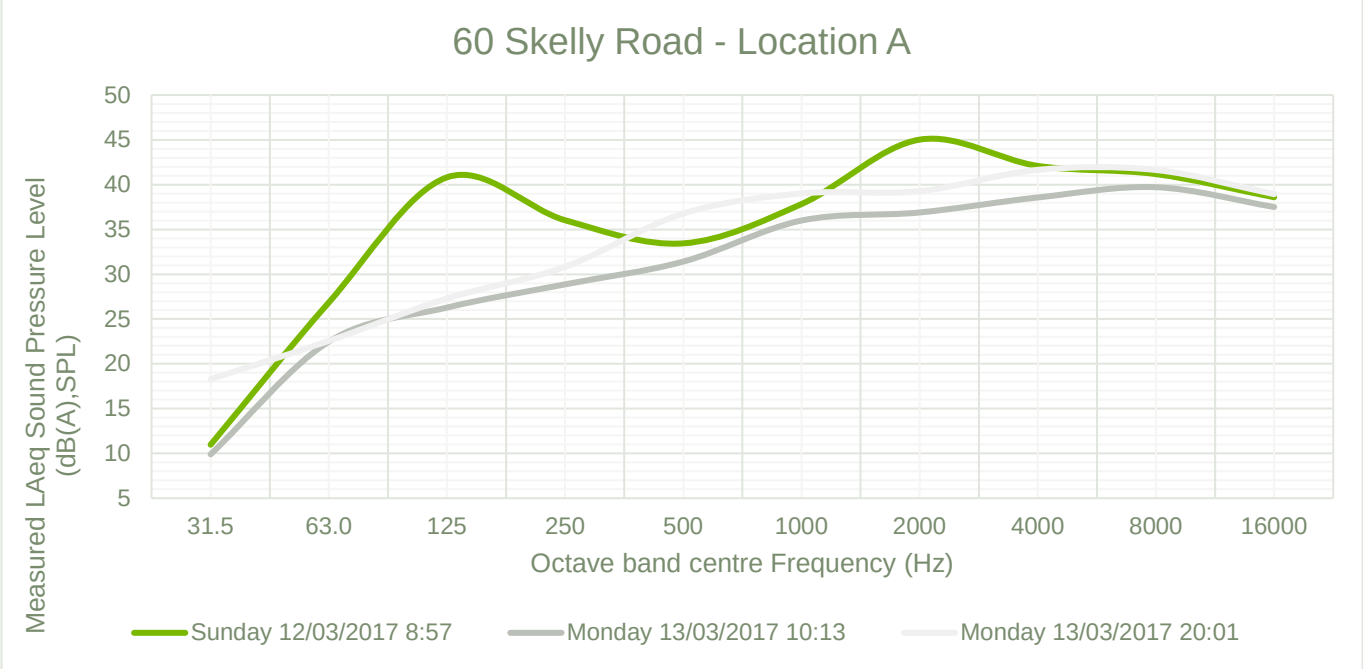
The primary contributor to the background and ambient noise levels at all measurement locations was the traffic noise on the nearby roads.

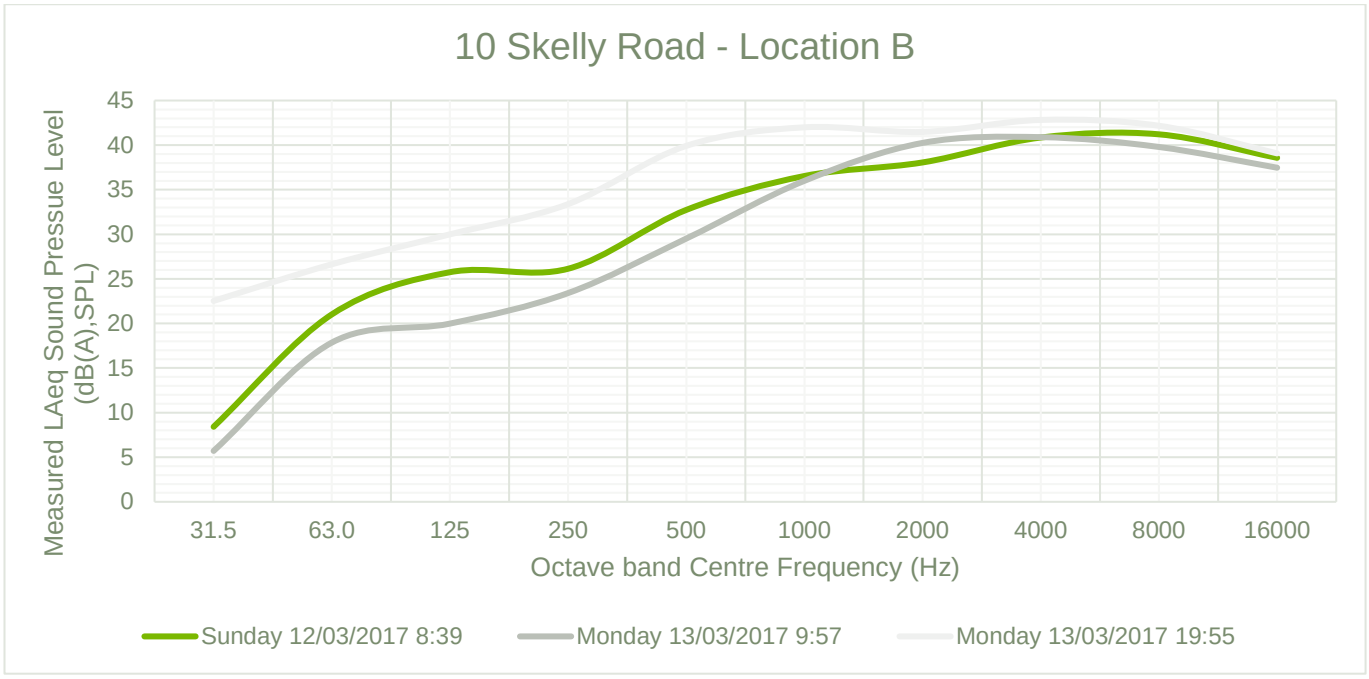
Based on the noise predictions resulting noise from the operation of trucks/ light commercial vehicles from the Stage 2 KVAR are considered compliant with the Conditions of Approval.

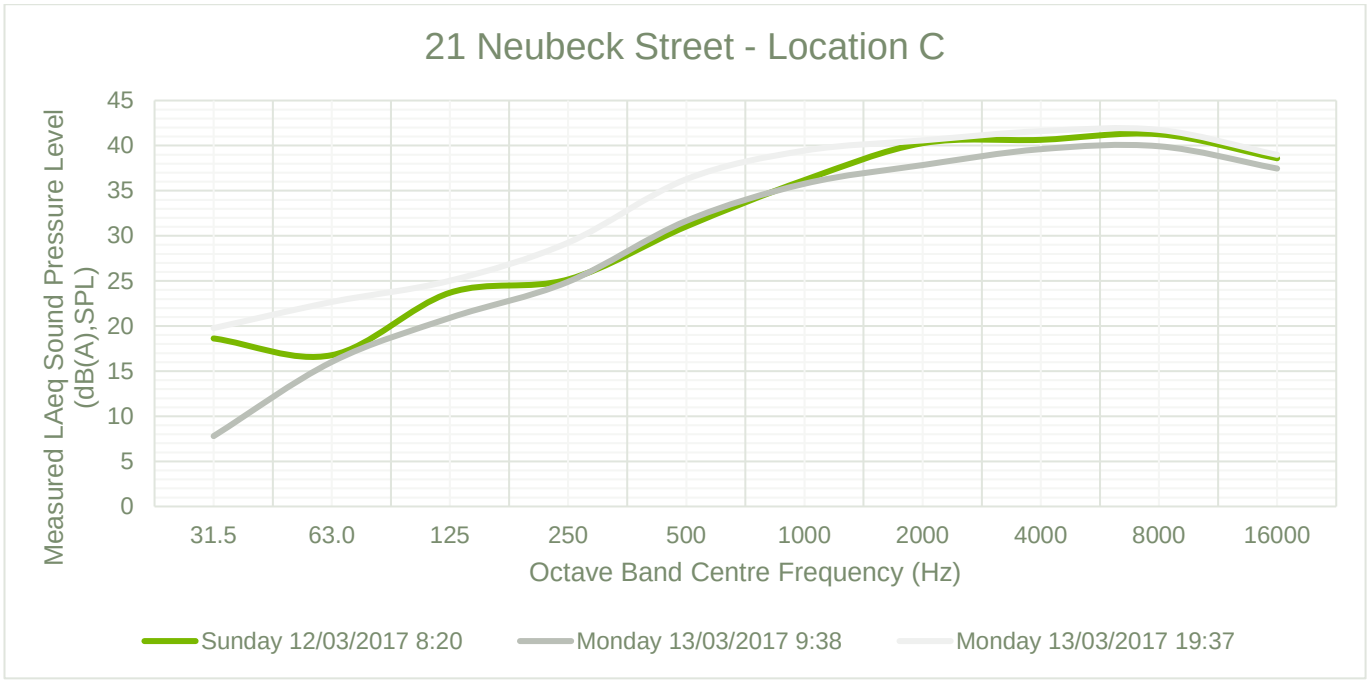
7 References

- 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.
- Office of Environment & Heritage (OEH) *Interim Construction Noise Guideline (ICNG).*
- Office of Environment & Heritage (OEH) *Industrial Noise Policy (INP)*.
- Australian Standard *AS 1055 1997: Acoustics – Description and measurement of environmental noise*.

Appendix A
Measured noise spectra




10 Skelly Road - Location B
Measured LAeq Sound Pressue Level (dB(A),SPL)
45
40
35
30
25
20
15
10
5
0
31.5
63.0
125
250
500
1000
2000
4000
8000
16000
Octave band Centre Frequency (Hz)
Sunday 12/03/2017 8:39
Monday 13/03/2017 9:57
Monday 13/03/2017 19:55


21 Neubeck Street - Location C
Measured LAeq Sound Pressure Level (dB(A),SPL)
45
40
35
30
25
20
15
10
5
0
31.5
63.0
125
250
500
1000
2000
4000
8000
16000
Octave Band Centre Frequency (Hz)
Sunday 12/03/2017 8:20
Monday 13/03/2017 9:38
Monday 13/03/2017 19:37

Appendix B
Glossary of terms

Term	Definition
Sound Pressure Level	Sound or noise is the sensation produced at the ear by very small fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range (from 20 microPascals to 60 Pascals). A scale that compresses this range to a more manageable size and that is best matched to subjective response is the logarithmic scale, rather than a linear scale.
Sound Pressure Level (Lp)	Is defined as: $L_P = 10\log_{10}\left(\frac{p^2}{p_{ref}^2}\right)dB$ In the above equation, p is the sound pressure fluctuation (above or below atmospheric pressure), and p_{ref} is 20 microPascals (2×10^{-5} Pa), the approximate threshold of hearing. To avoid a scale which is too compressed, a factor of 10 is included, giving rise to the decibel, or dB for short.
A-Weighted Decibel (dB(A)) & Loudness	In some circumstances, the sound pressure level is expressed as C-Weighted decibels, instead of the more common A-Weighted. The C-Weighting filter is designed to replicate the response of the human ear above 85 dB, and places a greater weighting on low frequency noise.
L_{Aeq}	The time averaged C-weighted sound pressure level for a time interval, as defined in AS1055.1. It is generally described as the equivalent continuous C-weighted sound pressure level that has the same mean square pressure level as a sound that varies over time. It can be considered as the average sound pressure level over the measurement period.
L_{Ceq}	The time averaged C-weighted sound pressure level for a time interval, as defined in AS1055.1. It is generally described as the equivalent continuous C-weighted sound pressure level that has the same mean square pressure level as a sound that varies over time. It can be considered as the average sound pressure level over the measurement period.
L_{An}	The sound level, which, for a specified time interval, in relation to an investigation of a noise, means the A-weighted sound pressure level that is equalled or exceeded for n% of the interval. Commonly used percentages are 1, 10, 90 & 99%.

Term	Definition
L_{Cpk}	The peak C-weighted sound pressure level for a time interval.
$L_{Cmax,T}$	The average maximum C-weighted sound pressure level, which, for the specified time interval, means the C-weighted sound pressure level during the interval obtained by using the fast time weighting and arithmetically averaging the maximum sound levels of the noise during the interval. Under certain conditions the 10th percentile noise level, $L_{C10,T}$, can represent the average maximum C-weighted sound pressure level.
L_{A10}	A-weighted noise level which is exceeded for only 10% of the measuring period. It is usually used as the descriptor for intrusive noise level and represents ambient road traffic noise in general.
L_{A90}	A-weighted noise level which is exceeded for 90% of the measuring period. It is usually used as the descriptor for background noise level during the measurement period.
L_{Amin}	Minimum A-weighted noise level detected during the measuring period. It refers to the minimum background noise detected.
Octave	Frequency bands allow a representation of the spectrum associated with a particular noise. They are an octave wide, meaning that the highest frequency in the band is just twice the lowest frequency, with all intermediate frequencies included and all other frequencies excluded. Each octave band is described by its centre frequency.
Maximum Exposure Time (Hours)	The maximum possible time a person can be safely exposed to a specific noise level (L_{Aeq}).
Sound Exposure Level (SEL)	Sound exposure level abbreviated as SEL and L_{AE}, is the total noise energy produced from a single noise event. The Sound Exposure Level is a metric used to describe the amount of noise from an event such as an individual aircraft flyover. It is computed from measured dB(A) sound levels. The Sound Exposure Level is the integration of all the acoustic energy contained within the event.

Appendix C
Site photograph

Figure 3 | Location D

Appendix D
Weather data

Table 7: Meteorological conditions during noise survey

Date	Time	Rainfall (mm)	Wind Speed 10m above ground (m/s)	Wind Direction (deg.)	Temp (°C)	Relative humidity (%)
12/03/2017	0:00	0.0	1.2	243	11	95
12/03/2017	0:15	0.0	1.2	234	10	96
12/03/2017	0:30	0.0	1.0	235	10	96
12/03/2017	0:45	0.0	1.0	229	10	97
12/03/2017	1:00	0.0	1.0	252	10	97
12/03/2017	1:15	0.0	1.2	232	10	97
12/03/2017	1:30	0.0	1.3	233	10	98
12/03/2017	1:45	0.0	1.2	236	9	97
12/03/2017	2:00	0.0	1.2	229	9	98
12/03/2017	2:15	0.0	1.0	244	9	98
12/03/2017	2:30	0.0	0.9	238	9	98
12/03/2017	2:45	0.0	1.1	235	9	98
12/03/2017	3:00	0.0	0.9	225	9	98
12/03/2017	3:15	0.0	1.4	229	9	98
12/03/2017	3:30	0.0	1.2	225	9	99
12/03/2017	3:45	0.0	1.2	230	9	99
12/03/2017	4:00	0.0	1.0	227	9	99
12/03/2017	4:15	0.0	0.9	252	9	99
12/03/2017	4:30	0.0	0.8	246	9	99
12/03/2017	4:45	0.0	1.1	222	8	99
12/03/2017	5:00	0.0	0.9	236	8	99
12/03/2017	5:15	0.0	1.3	226	8	99
12/03/2017	5:30	0.0	0.9	246	8	99
12/03/2017	5:45	0.0	0.5	240	8	99
12/03/2017	6:00	0.0	1.2	220	8	99

Date	Time	Rainfall (mm)	Wind Speed 10m above ground (m/s)	Wind Direction (deg.)	Temp (°C)	Relative humidity (%)
12/03/2017	6:15	0.0	1.2	231	9	99
12/03/2017	6:30	0.0	1.0	228	9	99
12/03/2017	6:45	0.0	0.5	165	11	99
12/03/2017	7:00	0.0	0.5	47	14	93
12/03/2017	7:15	0.0	0.7	51	16	82
12/03/2017	7:30	0.0	1.1	115	18	72
12/03/2017	7:45	0.0	1.8	284	20	59
12/03/2017	8:00	0.0	1.9	311	21	54
12/03/2017	8:15	0.0	1.9	224	21	52
12/03/2017	8:30	0.0	2.3	139	22	50
12/03/2017	8:45	0.0	2.2	142	23	47
12/03/2017	9:00	0.0	2.5	141	23	45
12/03/2017	9:15	0.0	2.8	166	24	44
12/03/2017	9:30	0.0	2.4	288	25	41
12/03/2017	9:45	0.0	3.0	171	25	39
12/03/2017	10:00	0.0	2.6	263	26	36
12/03/2017	10:15	0.0	3.1	261	26	34
12/03/2017	10:30	0.0	3.0	202	26	32
12/03/2017	10:45	0.0	4.2	119	27	31
12/03/2017	11:00	0.0	3.5	124	27	29
12/03/2017	11:15	0.0	3.6	209	27	27
12/03/2017	11:30	0.0	4.1	216	27	26
12/03/2017	11:45	0.0	2.8	260	27	25
12/03/2017	12:00	0.0	2.7	249	28	26
12/03/2017	12:15	0.0	2.5	279	28	25
12/03/2017	12:30	0.0	3.8	236	28	23
12/03/2017	12:45	0.0	3.7	206	28	22
12/03/2017	13:00	0.0	3.0	177	29	22
12/03/2017	13:15	0.0	3.3	214	28	21
12/03/2017	13:30	0.0	3.2	197	28	22
12/03/2017	13:45	0.0	2.5	97	28	22
12/03/2017	14:00	0.0	3.4	128	29	22
12/03/2017	14:15	0.0	3.3	178	29	21
12/03/2017	14:30	0.0	3.4	186	29	21
12/03/2017	14:45	0.0	3.7	163	28	21
12/03/2017	15:00	0.0	4.0	156	29	20

Date	Time	Rainfall (mm)	Wind Speed 10m above ground (m/s)	Wind Direction (deg.)	Temp (°C)	Relative humidity (%)
12/03/2017	15:15	0.0	3.6	191	29	19
12/03/2017	15:30	0.0	3.5	161	28	20
12/03/2017	15:45	0.0	2.9	210	29	20
12/03/2017	16:00	0.0	3.3	255	28	20
12/03/2017	16:15	0.0	2.8	271	28	21
12/03/2017	16:30	0.0	2.6	297	28	21
12/03/2017	16:45	0.0	2.7	298	27	22
12/03/2017	17:00	0.0	2.4	267	27	22
12/03/2017	17:15	0.0	3.6	181	27	26
12/03/2017	17:30	0.0	3.5	166	26	28
12/03/2017	17:45	0.0	4.2	120	26	29
12/03/2017	18:00	0.0	2.9	146	25	28
12/03/2017	18:15	0.0	2.8	117	25	27
12/03/2017	18:30	0.0	2.3	147	25	27
12/03/2017	18:45	0.0	1.6	198	24	29
12/03/2017	19:00	0.0	1.5	234	24	30
12/03/2017	19:15	0.0	1.4	300	23	32
12/03/2017	19:30	0.0	0.9	317	21	38
12/03/2017	19:45	0.0	1.3	255	20	43
12/03/2017	20:00	0.0	1.5	237	19	45
12/03/2017	20:15	0.0	1.3	238	19	47
12/03/2017	20:30	0.0	1.4	240	18	49
12/03/2017	20:45	0.0	1.4	239	18	49
12/03/2017	21:00	0.0	1.3	288	18	49
12/03/2017	21:15	0.0	1.0	319	18	49
12/03/2017	21:30	0.0	1.2	283	17	51
12/03/2017	21:45	0.0	1.6	238	17	51
12/03/2017	22:00	0.0	1.4	240	16	54
12/03/2017	22:15	0.0	1.6	241	16	55
12/03/2017	22:30	0.0	1.6	233	16	54
12/03/2017	22:45	0.0	1.3	212	16	55
12/03/2017	23:00	0.0	1.1	204	16	55
12/03/2017	23:15	0.0	0.9	212	16	56
12/03/2017	23:30	0.0	1.0	232	17	57
12/03/2017	23:45	0.0	1.3	250	16	59
13/03/2017	0:00	0.0	1.1	206	17	60

Date	Time	Rainfall (mm)	Wind Speed 10m above ground (m/s)	Wind Direction (deg.)	Temp (°C)	Relative humidity (%)
13/03/2017	0:15	0.0	1.1	229	17	61
13/03/2017	0:30	0.0	1.6	160	18	60
13/03/2017	0:45	0.0	1.7	219	18	60
13/03/2017	1:00	0.0	1.6	182	18	54
13/03/2017	1:15	0.0	1.1	239	18	56
13/03/2017	1:30	0.0	1.3	237	17	60
13/03/2017	1:45	0.0	1.0	237	16	64
13/03/2017	2:00	0.0	1.0	226	16	64
13/03/2017	2:15	0.0	1.5	240	16	66
13/03/2017	2:30	0.0	1.3	213	16	65
13/03/2017	2:45	0.0	1.1	238	16	65
13/03/2017	3:00	0.0	1.4	215	17	58
13/03/2017	3:15	0.0	1.1	198	17	61
13/03/2017	3:30	0.0	0.9	172	17	63
13/03/2017	3:45	0.0	1.1	223	17	65
13/03/2017	4:00	0.0	1.1	180	16	67
13/03/2017	4:15	0.0	0.6	115	16	68
13/03/2017	4:30	0.0	0.8	137	16	68
13/03/2017	4:45	0.0	0.8	128	16	68
13/03/2017	5:00	0.0	1.0	241	16	71
13/03/2017	5:15	0.0	0.6	175	15	71
13/03/2017	5:30	0.0	0.7	151	15	73
13/03/2017	5:45	0.0	1.3	183	15	72
13/03/2017	6:00	0.0	1.4	239	14	77
13/03/2017	6:15	0.0	1.9	231	14	76
13/03/2017	6:30	0.0	1.6	215	15	74
13/03/2017	6:45	0.0	1.2	192	16	70
13/03/2017	7:00	0.0	0.8	120	17	67
13/03/2017	7:15	0.0	0.6	250	17	67
13/03/2017	7:30	0.0	0.7	268	18	66
13/03/2017	7:45	0.0	1.3	186	19	62
13/03/2017	8:00	0.0	1.5	193	19	61
13/03/2017	8:15	0.0	0.9	212	20	61
13/03/2017	8:30	0.0	1.3	286	20	64
13/03/2017	8:45	0.0	0.8	272	20	64
13/03/2017	9:00	0.0	1.5	291	20	64

Date	Time	Rainfall (mm)	Wind Speed 10m above ground (m/s)	Wind Direction (deg.)	Temp (°C)	Relative humidity (%)
13/03/2017	9:15	0.0	4.0	258	19	63
13/03/2017	9:30	0.0	5.1	250	18	68
13/03/2017	9:45	0.0	6.1	248	16	77
13/03/2017	10:00	0.0	5.0	245	16	83
13/03/2017	10:15	0.0	4.4	236	17	79
13/03/2017	10:30	0.0	4.1	223	18	70
13/03/2017	10:45	0.0	3.9	222	19	65
13/03/2017	11:00	0.0	2.6	202	20	61
13/03/2017	11:15	0.0	2.4	165	21	58
13/03/2017	11:30	0.0	3.4	143	21	56
13/03/2017	11:45	0.0	3.6	127	21	58
13/03/2017	12:00	0.0	3.7	137	22	56
13/03/2017	12:15	0.0	3.1	120	23	52
13/03/2017	12:30	0.0	2.6	111	22	53
13/03/2017	12:45	0.0	2.1	99	23	52
13/03/2017	13:00	0.0	2.2	89	24	48
13/03/2017	13:15	0.0	2.8	99	25	47
13/03/2017	13:30	0.0	3.4	93	24	48
13/03/2017	13:45	0.0	3.5	76	24	49
13/03/2017	14:00	0.0	3.2	94	24	51
13/03/2017	14:15	0.0	3.6	97	23	54
13/03/2017	14:30	0.0	3.5	105	23	57
13/03/2017	14:45	0.0	3.4	101	23	60
13/03/2017	15:00	0.0	3.4	106	22	62
13/03/2017	15:15	0.0	4.0	99	22	63
13/03/2017	15:30	0.0	3.2	108	22	65
13/03/2017	15:45	0.0	3.9	105	21	64
13/03/2017	16:00	0.0	3.2	107	21	63
13/03/2017	16:15	0.0	3.4	104	21	63
13/03/2017	16:30	0.0	4.7	107	21	66
13/03/2017	16:45	0.0	4.5	108	20	76
13/03/2017	17:00	0.0	4.5	106	19	80
13/03/2017	17:15	0.0	4.4	113	19	80
13/03/2017	17:30	0.0	4.2	112	19	81
13/03/2017	17:45	0.0	3.5	112	19	82
13/03/2017	18:00	0.0	3.7	106	19	82

Date	Time	Rainfall (mm)	Wind Speed 10m above ground (m/s)	Wind Direction (deg.)	Temp (°C)	Relative humidity (%)
13/03/2017	18:15	0.0	3.9	100	19	83
13/03/2017	18:30	0.0	4.2	105	18	83
13/03/2017	18:45	0.0	3.8	100	18	84
13/03/2017	19:00	0.0	3.5	112	18	84
13/03/2017	19:15	0.0	3.5	107	18	85
13/03/2017	19:30	0.0	3.8	105	18	84
13/03/2017	19:45	0.0	3.4	87	18	85
13/03/2017	20:00	0.0	3.1	77	18	85
13/03/2017	20:15	0.0	4.3	71	18	84
13/03/2017	20:30	0.0	4.1	67	18	84
13/03/2017	20:45	0.0	3.2	56	18	83
13/03/2017	21:00	0.0	2.7	56	18	84
13/03/2017	21:15	0.0	3.0	136	18	83
13/03/2017	21:30	0.0	1.3	156	16	82
13/03/2017	21:45	0.0	0.9	227	16	82
13/03/2017	22:00	0.0	0.7	213	16	82
13/03/2017	22:15	0.0	0.9	233	16	84
13/03/2017	22:30	0.0	1.4	261	16	86
13/03/2017	22:45	0.0	0.7	274	16	86
13/03/2017	23:00	0.0	1.3	152	16	88
13/03/2017	23:15	0.0	2.4	114	17	87
13/03/2017	23:30	0.0	2.4	116	17	86
13/03/2017	23:45	0.0	2.8	117	17	86

Highlighted cell shows exceedance of wind speed above the nominated 5m/s as per AS 1055.1.

Aurecon Australasia Pty Ltd
ABN 54 005 139 873
Level 5, 116 Military Road
Neutral Bay NSW 2089
PO Box 538
Neutral Bay NSW 2089
Australia
T +61 2 9465 5599
F +61 2 9465 5598
E sydney@aurecongroup.com
W aurecongroup.com