aurecon

Project: Kerosene Vale Ash Repository Stage 2

Ongoing operational noise measurements

Prepared for: Delta Electricity

Project: 226131

10 December 2012

Document Control Record

Document prepared by:

Aurecon Australia Pty Ltd
ABN 54 005 139 873
Level 2, 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				
Document ID		226131-KV-REP-01-REVA	**Project Number**		226131	
File Path		\\Aurecon.info\Shares\AUSYD\Projects\BG\226131\3.Project Delivery\Acoustics\Nov 2012 survey\Report\AL251112 KVAR Compliance Noise revA.docx				
Client		Delta Electricity	**Client Contact**		Coleen Milroy	
Rev	**Date**	**Revision Details/Status**	**Prepared by**	**Author**	**Verifier**	**Approver**
A	10 December 2012	Initial Draft	AL	AL	BD	GM
Current Revision		**A**				

Approval			
Author Signature		Approver Signature	
Name	Akil Lau	Name	Graham Mackay
Title	Acoustic Consultant	Title	Technical Director

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 25th November and Monday 26th November 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 25 November and Monday 26 November 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 metres 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 conditions, 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 3 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	-

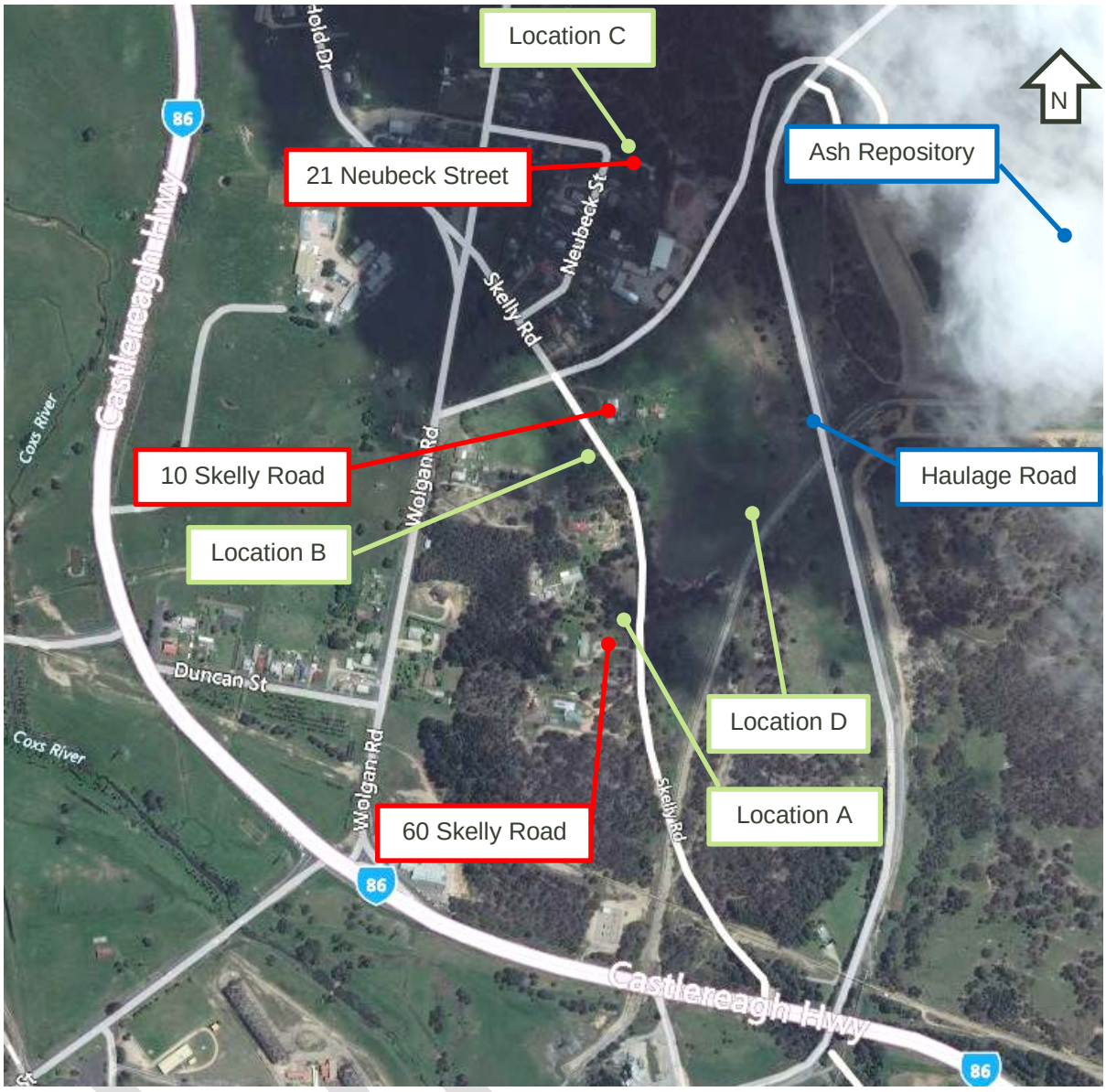


Figure 2: Noise measurement locations

General observation regarding the 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 a nearby construction site, background noise from the Wallerawang Power Station as well as intermittent traffic noise from nearby Castlereagh Highway and Wolgan Road. While there was significant background noise contribution from the activities mentioned above, truck engine noise was clearly audible at the measurement locations.

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. 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 engine noise originating from Delta Electricity Power Plant during the morning measurements on 25th and 26th November 2012. After investigation is was apparent that these noises were originating from a dozer operating on the coal stockpile inside the Delta Power Plant site. Noise from birds and insects also contributed to the background noise at this location.

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, noise from birds/ insects/ animals and construction activity from a residence near Wolgan 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 and the trucks moving on the haulage road could be easily identified. Noise of reversing alarms and engine noise from the dozer working inside the Delta Electricity Power Plant was also audible at this location. The background noise level (L_{A90}) was observed to be approximately 3 – 6 dBA higher specifically during the Monday morning measurement compared to Sunday and Monday evening measurements (35 – 38) essentially due to the contribution from additional trucks movements on the haulage road.

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 engine idle noise, loading and unloading, reversing alarm, etc.) from a nearby residence across Wolgan Road during the morning measurements. 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 truck engine noise was clearly audible. Background noise (L_{A90}) during the Monday evening measurement was observed to be higher that rest of the measurements at this location predominantly due to the noise contribution from insects/ crickets (a detectable tone in the third-octave band centre frequency of 4KHz).

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 07/11/2011 and updated based on onsite measurements. 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. Based on the information provided by Delta Electricity, the number of trucks pass by varied from a maximum of 8 trucks (including north bound and south bound trucks during 25/11/2012 – morning measurements at three locations) to minimum of 6 trucks (including north bound and south bound trucks during 26/11/2012 – evening measurements at three locations). 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
25/11/2012 7:20	0	2.2	341	61	22.1	Unstable
25/11/2012 7:25	0	2.5	333	62	21.6	Unstable
25/11/2012 7:30	0	2.8	344	62	21.9	Neutral 1
25/11/2012 7:35	0	2.4	308	61	22.1	Unstable
25/11/2012 7:40	0	2.6	328	61	22.2	Neutral 2
25/11/2012 7:45	0	2.5	344	61	22.4	Unstable
25/11/2012 7:50	0	1.2	325	60	22.8	Unstable
25/11/2012 7:55	0	1.6	332	59	22.6	Unstable
25/11/2012 8:00	0	2.4	325	58	22.9	Neutral 2
25/11/2012 8:05	0	1.6	308	58	23.1	Unstable
25/11/2012 8:10	0	1.0	357	56	24.1	Unstable
25/11/2012 8:15	0	2.6	333	54	24.2	Neutral 2
25/11/2012 8:20	0	1.3	280	53	24.0	Unstable
25/11/2012 8:25	0	1.8	326	52	24.5	Unstable
25/11/2012 8:30	0	2.0	356	50	25.2	Unstable
25/11/2012 18:25	0.2	1.1	38	67	22.4	Unstable
25/11/2012 18:30	0.8	1.1	40	74	21.4	Unstable
25/11/2012 18:35	0	0.7	237	79	20.5	Unstable
25/11/2012 18:40	0.2	1.8	257	87	19.7	Neutral 2
25/11/2012 18:45	0	2.0	262	90	19.1	Intermediate
25/11/2012 18:50	0	1.6	229	92	18.9	Neutral
25/11/2012 18:55	0	1.1	243	93	18.9	Neutral 2
25/11/2012 19:00	0	1.1	268	93	18.7	Neutral 1

Time and date	Rainfall (mm)	Wind Speed (m/s)	Wind Direction (deg)	Relative Humidity (%)	Temp (°C)	Atmospheric Stability
25/11/2012 19:05	0	0.9	224	94	18.6	Unstable
25/11/2012 19:10	0	1.2	262	94	18.5	Unstable
25/11/2012 19:15	0	1.4	250	94	18.4	Neutral 1
25/11/2012 19:20	0	1.7	245	93	18.3	Neutral 1
25/11/2012 19:25	0	1.6	262	94	18.1	Intermediate
25/11/2012 19:30	0	1.4	267	94	18.0	Neutral
26/11/2012 7:10	0	1.4	357	62	21.9	Unstable
26/11/2012 7:15	0	1.5	358	62	22.3	Neutral 1
26/11/2012 7:20	0	1.9	11	59	22.4	Unstable
26/11/2012 7:25	0	1.4	331	59	22.9	Unstable
26/11/2012 7:30	0	2.0	340	56	23.4	Unstable
26/11/2012 7:35	0	2.6	327	55	23.6	Neutral 1
26/11/2012 7:40	0	2.1	357	55	23.6	Unstable
26/11/2012 7:45	0	2.6	12	55	23.6	Neutral 1
26/11/2012 7:50	0	2.5	10	56	23.3	Unstable
26/11/2012 7:55	0	2.3	8	55	23.9	Neutral 1
26/11/2012 8:00	0	2.7	354	55	23.8	Neutral 2
26/11/2012 8:05	0	2.2	339	53	24.4	Unstable
26/11/2012 8:10	0	2.3	14	52	24.5	Unstable
26/11/2012 8:15	0	2.3	2	53	24.5	Unstable
26/11/2012 8:20	0	1.6	334	52	24.7	Unstable
26/11/2012 20:10	0	1.3	237	90	16.5	Neutral
26/11/2012 20:15	0	1.6	246	91	16.4	Neutral
26/11/2012 20:20	0	1.7	264	92	16.2	Neutral
26/11/2012 20:25	0	1.2	239	92	16.1	Neutral 1
26/11/2012 20:30	0	1.0	250	92	16.1	Intermediate
26/11/2012 20:35	0	1.4	200	92	16.1	Neutral
26/11/2012 20:40	0	0.4	235	92	16.2	Unstable
26/11/2012 20:45	0	0.6	327	92	16.2	Unstable
26/11/2012 20:50	0	0.9	273	93	16.2	Neutral 1
26/11/2012 20:55	0	1.8	264	92	16.3	Intermediate
26/11/2012 21:00	0	1.3	249	91	16.4	Neutral 1
26/11/2012 21:05	0	0.8	203	92	16.4	Neutral
26/11/2012 21:10	0	0.4	218	92	16.5	Neutral 2

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	25/11/2012	07:29	41	63	43	35	0	2	2
B	25/11/2012	07:50	45	73	43	35	1	2	3
A	25/11/2012	08:09	40	69	41	37	1	2	3
C	25/11/2012	18:29	42	65	43	34	1	0	1
B	25/11/2012	18:51	42	55	45	38	1	2	3
A	25/11/2012	19:10	43	62	44	38	1	2	3
C	26/11/2012	07:18	43	63	44	39	3	1	4
B	26/11/2012	07:41	45	60	47	41	5	1	6
A	26/11/2012	08:04	44	72	44	40	2	3	5
C	26/11/2012	20:12	47	71	47	44	1	1	2
B	26/11/2012	20:31	41	54	43	38	1	2	3
A	26/11/2012	20:49	46	66	44	37	1	2	3

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 levels at any of the measured locations were not contributed by KVAR operations.

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 $L_{Aeq\ (15\ min)}$ exceed the assessment criteria of $L_{Aeq\ (15\ min)}$ of 40 dBA. The background noise (L_{A90}) from the various noise sources seldom (2 occasions) exceeded the noise criteria of 40dBA during 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), and the distance of the truck noise source from the receiver. The assessment does not include any potential barrier effects. As per the information provided by Delta Electricity, the number of truck pass-bys varied from a maximum of 8 trucks (including north bound and south bound trucks during 25/11/2012 – morning measurements at three locations) to minimum of 6 truck (including north bound and south bound trucks during 26/11/2012 – evening measurements at three locations). Trucks were operating at a constant rate, with approximate 15-30 minute circuits for each truck from 7am – 10pm daily. Based on the information collected during the measurement Table 6 provides the number of average ash trucks that have been considered for calculating the contribution from ash trucks on the nearest sensitive receivers. Noise predictions are shown in Table 6 below are based on the worst case scenario of the trucks counted during the onsite measurements.

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	3.5	34	40
10 Skelly Road	240	3.75	37	40
21 Neubeck Street	160	2.25	39*	40

Note * - Does not include barrier attenuation from earth mound.

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 25 November and Monday 26 November 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.

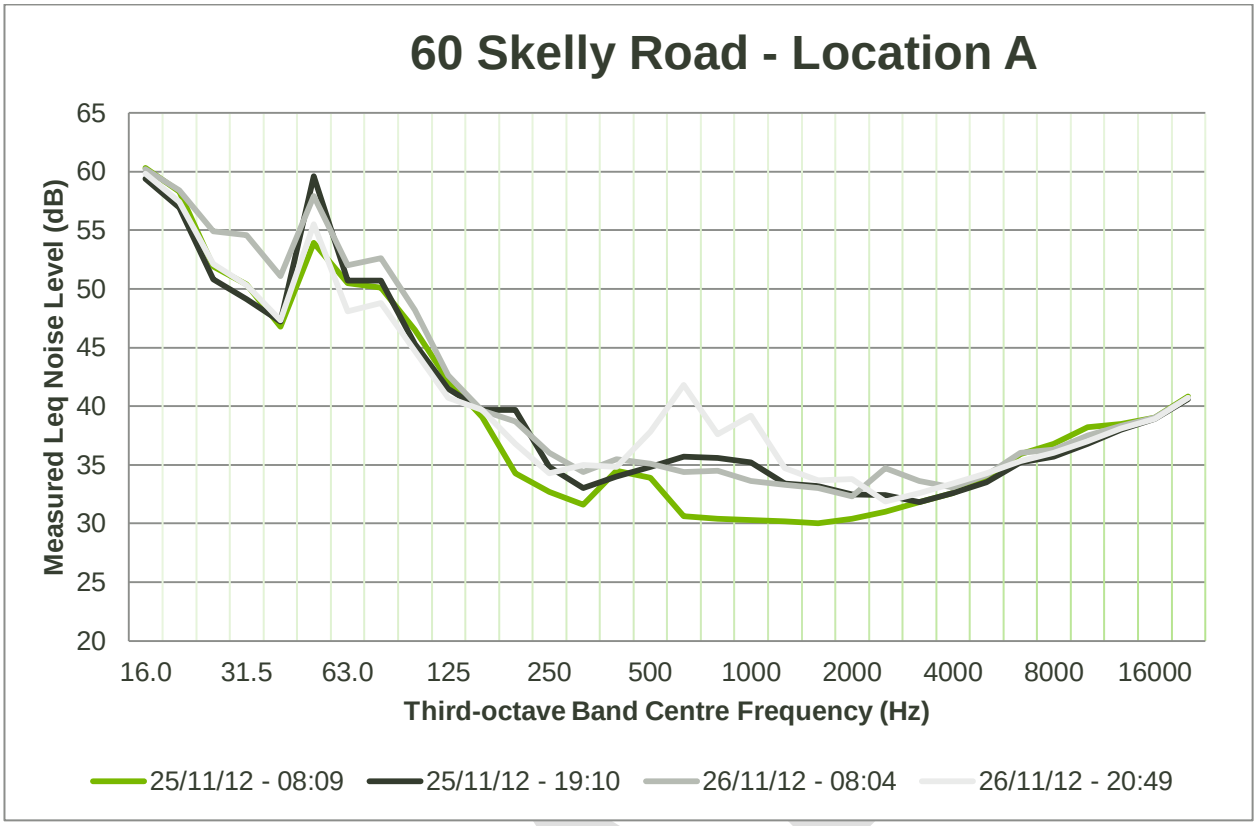
The primary contributors to the background and ambient noise levels at all the locations were from the traffic noise and hum from Delta Electricity Power Station. The noise contribution from KVAR Stage 2 activities alone could not be determined based on ambient noise measurements due to contamination 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. 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.

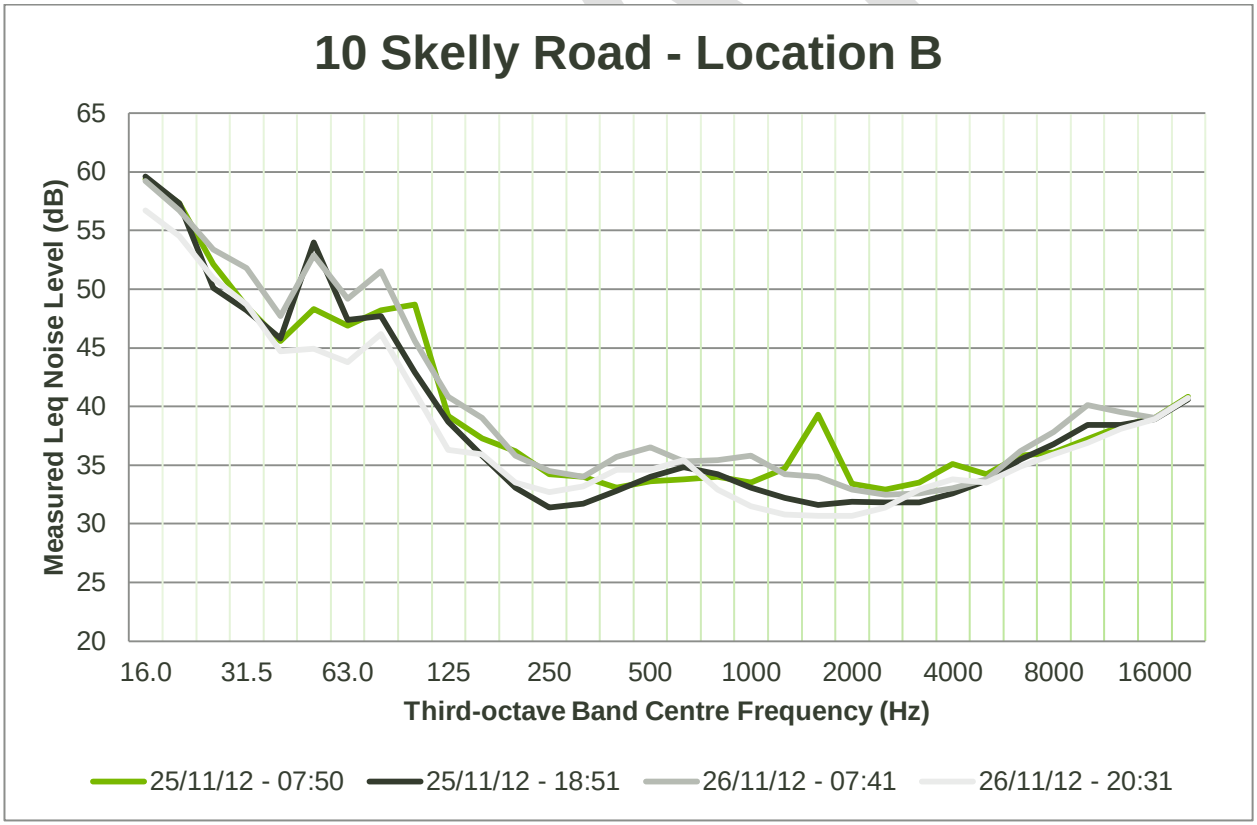
6. References

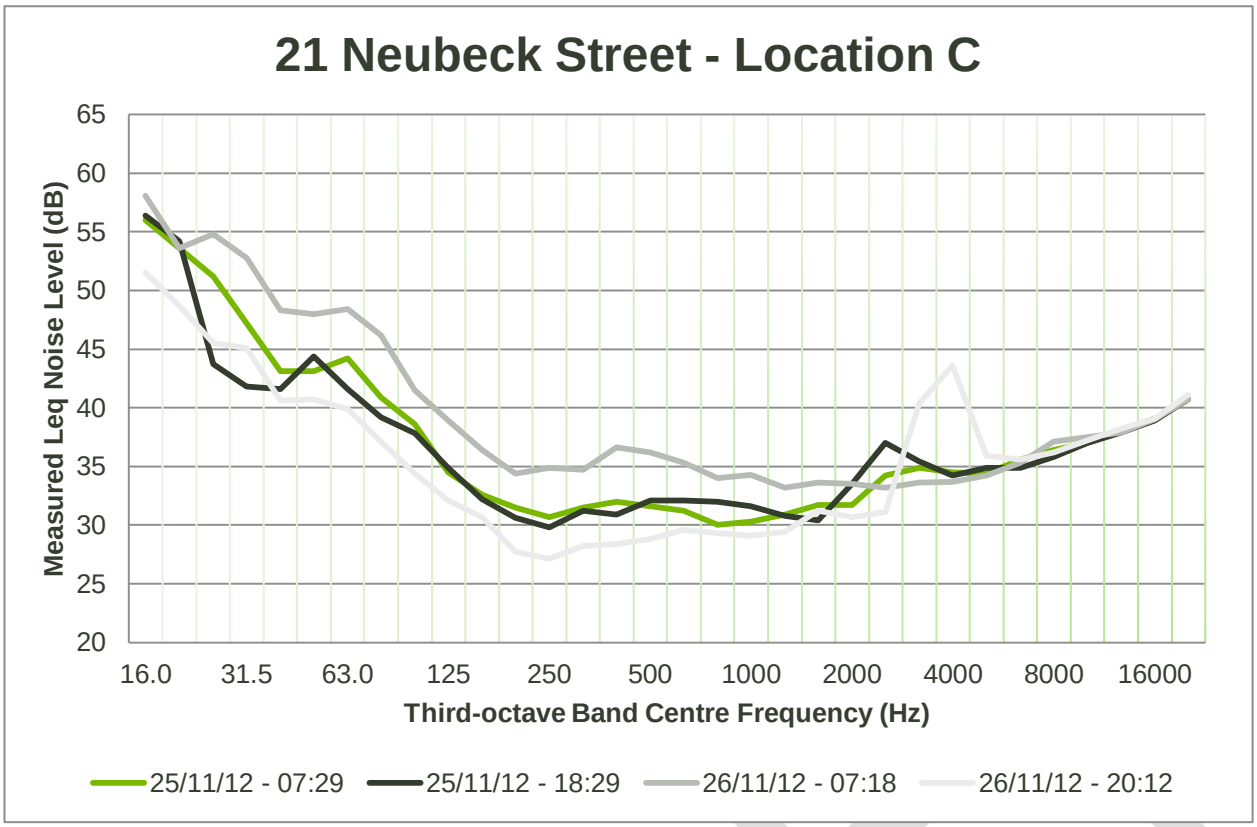
- Kerosene Vale Stage 2 Ash Repository, Operational Environmental Management Plan (OEMP), Parsons Brinckerhoff, April 2009, which includes:
  - Appendix A: KVAR Stage 2 Operations, Operational Noise and Vibration Management Plan (ONVMP), Parsons Brinckerhoff, April 2009
- Project Approval (PA), Application: 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)
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)
25/11/12 - 08:09
25/11/12 - 19:10
26/11/12 - 08:04
26/11/12 - 20:49


10 Skelly Road - Location B
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)
25/11/12 - 07:50
25/11/12 - 18:51
26/11/12 - 07:41
26/11/12 - 20:31


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)
25/11/12 - 07:29
25/11/12 - 18:29
26/11/12 - 07:18
26/11/12 - 20:12

Aurecon Australia Pty Ltd
ABN 54 005 139 873
Level 2, 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

Aurecon offices are located in:
Angola, Australia, Bahrain, Botswana, China, Ethiopia, Hong Kong, Indonesia, Lesotho, Libya, Malawi, Mozambique, Namibia, New Zealand, Nigeria, Philippines, Singapore, South Africa, Swaziland, Tanzania, Thailand, Uganda, United Arab Emirates, Vietnam.