STRATFORD MINING COMPLEX

Monthly Compliance Noise Monitoring
September 2019

Prepared for:

Stratford Coal Pty Ltd
PO Box 168
GLOUCESTER NSW 2422

SLR Ref: 630.11771-R22
Version No: -v1.0
October 2019

PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
10 Kings Road
New Lambton NSW 2305 Australia
(PO Box 447 New Lambton NSW 2305 Australia)
T: +61 2 4037 3200
E: newcastleau@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Stratford Coal Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.11771-R22-v1.0	15 October 2019	Jordan Murray	Martin Davenport	Martin Davenport

CONTENTS

1 INTRODUCTION 5
2 SMC NOISE CRITERIA 1
2.1 Project Approval Schedule 3 Environmental Performance Conditions 1
2.2 EPL Noise Limits – SMC Operations 3
2.3 Noise Limits at the Nominated Attended Noise Monitoring Locations 3
2.4 Rail Noise Goals 3
2.5 Assessment of Low-frequency Emissions 4
3 OPERATIONAL NOISE MONITORING METHODOLOGY 4
3.1 General Requirements 4
3.2 Operator-attended Noise Monitoring Locations 5
4 RESULTS 7
4.1 Operator-attended Noise Monitoring - SMC Operational Activity 7
4.1.1 Operator-attended Noise Survey Results – 'Atkins' 8
4.1.2 Operator-attended Noise Survey Results - 'Clarke' 10
4.1.3 Operator-attended Noise Survey Results - 'Hall' 11
4.1.4 Operator-attended Noise Survey Results - 'Lowrey' 12
4.1.5 Operator-attended Noise Survey Results - 'Pryce-Jones' 13
4.1.6 Operator-attended Noise Survey Results – 'Van der Drift' 14
4.2 RTNM Verification Monitoring 15
4.3 Rail Noise Monitoring 15
5 PERFORMANCE ASSESSMENT 16
5.1 Operations 16
5.2 Sleep Disturbance 17
6 CONCLUSION 17

DOCUMENT REFERENCES

TABLES

Table 1 Noise Limits for the Nominated Noise Monitoring Locations 3
Table 2 ARTC EPL 3142 Noise Objectives 3
Table 3 SMC Operational Noise Monitoring Locations 5
Table 4 Operator-attended Noise Survey Results - 'Atkins' 8
Table 5 Atkins Day – NPfI Low Frequency Analysis 9
Table 6 Operator-attended Noise Survey Results - 'Clarke' 10
Table 7 Operator-attended Noise Survey Results - 'Hall' 11

CONTENTS

Table 8 Attended Noise Survey Results - 'Lowrey' 12
Table 9 Attended Noise Survey Results – 'Pryce Jones' 13
Table 10 Attended Noise Survey Results – 'Van der Drift' 14
Table 11 Attended Noise Survey Results - Real Time Noise Monitoring Locations 15
Table 12 Operator-attended Rail Noise Monitoring Results 15
Table 13 Performance Assessment – Operations 16
Table 14 Performance Assessment – Sleep Disturbance 17

FIGURES

Figure 1 Stratford Mining Complex Attended Noise Monitoring Locations 6

APPENDICES

Appendix A Acoustic Terminology
Appendix B Operator Attended Noise Survey Charts

1 Introduction

Stratford Coal Pty Limited (DCPL), a wholly owned subsidiary of Yancoal Australia Limited (Yancoal), has commissioned SLR Consulting Australia Pty Ltd (SLR) to conduct monthly noise monitoring for the Stratford Mining Complex (SMC) operations guided by the requirements of the *Stratford Mining Complex (Stratford Extension Project) Noise Management Plan* (NMP), Document No. NMP-R03-A, dated 17 June 2019. This report presents the results and findings from the operator-attended noise surveys conducted between Thursday 26 September 2019 and Monday 30 September 2019.

It is understood that the SMC collectively comprises the Stratford Coal Mine (SCM), the Bowens Road North Open Cut (BRNOC) and the associated coal processing and handling facilities. Run-of-mine (ROM) coal from the Duralie Coal Mine (DCM) is transported by rail to the SMC, where it is processed along with ROM coal from the SCM and BRNOC. SMC coal is then loaded and railed on the North Coast Railway to the port of Newcastle.

The objectives of the noise monitoring programme for this operating period were as follows:

- Conduct three rounds of external operator-attended noise measurements at the six nominated locations, representative of receivers in the area surrounding the SMC. The six nominated external operator-attended noise measurement locations are:
  - Atkins – Off Wenhams Cox Road, Stratford
  - Clarke – Off Wenhams Cox Road, Stratford
  - Hall – Upper Avon Road
  - Lowrey – Off Crowthers Road, Stratford
  - Pryce Jones – The Bucketts Way, Craven
  - Van der Drift – Wood Street. Stratford

  Noise monitoring will occur for a day, evening and night period. The day, evening and night periods being those defined in the NSW *Industrial Noise Policy* (EPA 2000).
- The operator will quantify and characterise the maximum (L_{Amax}) and the intrusive (L_{Aeq} and L_{Ceq}) noise level contributions from SMC operations over a 15 minute measurement period. In addition, the operator will quantify and characterise the overall levels of ambient noise (i.e. L_{Amax}, L_{A1}, L_{A10}, L_{A50}, L_{A90}, and L_{Aeq}) over the 15 minute measurement interval.
- Assess the noise emissions of SMC and determine compliance with respect to the limits contained in the NMP.

In addition to monthly noise monitoring at the nominated residential receivers, the NMP requires quarterly noise monitoring of rail activity and verification monitoring of the Real Time Noise Monitor (RTNM) network.

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

2 SMC Noise Criteria

The figures presented in this Section are extracts from the *Stratford Extension Project* (SSD-4966) Development Consent dated 29 May 2015.

2.1 Project Approval Schedule 3 Environmental Performance Conditions

ACQUISITION UPON REQUEST

1. Upon receiving a written request for acquisition from an owner of the land listed in Table 1, the Applicant shall acquire the land in accordance with the procedures in conditions 5-6 of Schedule 4.

Table 1: Land subject to acquisition upon request

Property ID	
40/51/Cr1 – L. Blanch	42 – D. Blanch
Cr7 – Pryce-Jones	Cr 2 – Boorer

Note: To interpret the location referred to in Table 1 see the applicable figure in Appendix 5.

However, the obligation to acquire a property does not apply if the Applicant has a negotiated agreement with the owner/s of the relevant land that sets aside acquisition under the terms of this consent, and the Applicant has advised the Department in writing of the terms of this agreement.

ADDITIONAL MITIGATION UPON REQUEST

2. Upon receiving a written request from the owner of any residence on the land listed in Tables 1 and 2, the Applicant shall implement additional noise mitigation measures (such as double glazing, insulation, and/or air conditioning) at the residence in consultation with the owner. These measures must be reasonable and feasible and directed towards reducing the noise impacts of the development on the residence.

If within 3 months of receiving this request from the owner, the Applicant and the owner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

Table 2: Land subject to additional noise mitigation upon request

Property ID	***Property ID***
31(1) – Isaac	60 – Healy / Greenwood
44 – Cross / Jane	36 – Wallace
37 – Worth	29 – Ward
15(3) – Falla	

Note: To interpret the locations referred to in Table 2 see the applicable figure in Appendix 5.

However, the obligation to implement noise mitigation measures does not apply if the Applicant has a negotiated agreement with the owner/s of the relevant residence or land that sets aside noise mitigation measures under the terms of this consent, and the Applicant has advised the Department in writing of the terms of this agreement.

NOISE

Hours of Operation

3. The Applicant shall comply with the operating hours in Table 3.

Table 3: Operating hours

Activity	Operating Hours
• Open cut mining operations in the Bowens Road North and Roseville West Extension pits • Recovery and transport of CHPP rejects for re-processing • Construction of the noise mitigation bunds on the western side of the Avon North, Roseville West Extension and Stratford East pits	7 am to 6 pm, 7 days per week
• Open cut mining operations in the Avon North and Stratford East pits • Coal processing, loading and dispatch of product coal trains	24 hours a day, 7 days per
• Maintenance activities	week

Noise Criteria

4. The Applicant shall ensure that the noise generated by the development does not exceed the criteria in Table 4 at any residence on privately-owned land.

Table 4: Noise criteria dB(A)

Land	Day $L_{Aeq(15\ min)}$	Evening $L_{Aeq(15\ min)}$	Night $L_{Aeq(15\ min)}$	Night $L_{A1\ (1\ min)}$
40/51/Cr1 – L. Blanch	43	43	43	50
Cr7 – Pryce-Jones	43	43	43	49
42 – D. Blanch	42	42	42	50
Cr 2 – Boorer	41	41	41	49
31(1) – Isaac	40	40	40	48
36 – Wallace	39	39	39	47
44 – Cross / Jane				
60 – Healy / Greenwood	39	39	39	45
37 – Worth	38	38	38	46
29 – Ward	38	38	37	45
23 – Bagnall	37	37	37	45
31(2) – Isaac				
296 – Watson				
297 – Bosma				
298 – Yates	36	36	36	45
15(3) – Falla	39	35	35	45
15(2) – Falla	36	35	35	45
Stratford Village	37	36	35	45
All other privately-owned residences	35	35	35	45

- *To interpret the locations referred to in Table 4 see the applicable figure(s) in Appendix 5.*
- *Stratford village is shown on the figure(s) in Appendix 5.*

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy*. Appendix 6 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Applicant has a negotiated agreement with the owner/s of the relevant residence or land to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

1. The noise criteria in Table 4 in Schedule 3 are to apply to a receiver under all meteorological conditions except under:
   (a) wind speeds greater than 3 m/s at 10 m above ground level; or
   (b) temperature inversion conditions between 1.5°C and 3°C/100 m and wind speed greater than 2 m/s at 10 m above ground level; or
   (c) temperature inversion conditions greater than 3°C/100 m.

2.2 EPL Noise Limits – SMC Operations

The noise limits specified in EPL 5161 are consistent with the noise criteria specified in SSD-4966.

2.3 Noise Limits at the Nominated Attended Noise Monitoring Locations

The site specific noise limits for the six nominated attended noise monitoring locations are summarised in **Table 1**.

Table 1 Noise Limits for the Nominated Noise Monitoring Locations

Locality	Intrusiveness Criteria $L_{Aeq(15minute)}$			Night $L_{A1(1minute)}$ Criterion
	Day	Evening	Night	Night
Atkins[1]	35	35	35	45
Clarke[1,2]	37	37	37	45
Hall	35	35	35	45
Lowrey	35	35	35	45
Pryce Jones[3]	43	43	43	49
Van der Drift	37	36	35	45

Note 1: Owned by Stratford Coal Pty Ltd

Note 2: Criteria adopted from Bagnall as a guide only and are not definitive at this location.

Note 3: Land subject to acquisition upon request.

2.4 Rail Noise Goals

The NMP has adopted ARTC's EPL 3142 noise goals as criteria for the assessment of SMC rail transport noise. The noise objectives specified in ARTC's EPL 3142 apply at 1 m from the façade of affected residential properties and are provided in **Table 2**.

Table 2 ARTC EPL 3142 Noise Objectives

Descriptor	Rail Traffic Goal dBA
Daytime/Evening $L_{Aeq(15hour)}$	65
Night-time $L_{Aeq(9hour)}$	60
Maximum Pass-by L_{Amax}	85

2.5 Assessment of Low-frequency Emissions

To address the low-frequency noise assessment issues raised in the 2014 Independent Environmental Audit, as outlined in the VIPAC letter (29N-15-0009-TNT-472681-0, dated 26 February 2015), the following analysis of the operator-attended monitoring data was proposed:

> *…a full L_{Ceq} minus L_{Aeq} spectrum low frequency analysis will be conducted on all noise compliance measurements where the mine noise contribution is deemed to be the dominant noise source. This will be conducted in accordance with the guidance set out in the INP in accordance with the requirements of Development Consent 23-98/99 Schedule 3 Condition 7(a) and Development Consent 39-02-01 Schedule 2 Condition 6.4C(a)(i).*

The low-frequency analysis proposed above shall also serve to meet the *Compliance Monitoring* requirement of Section 5(d) of Appendix 6 *Noise Compliance Assessment* of the Stratford Extension Project Development Consent (SSD-4966, dated 29 May 2015), that states:

> *…the use of an appropriate modifying factor for low frequency noise to be applied during compliance testing at any individual residence if low frequency noise is present (in accordance with the INP) and before comparison with the specified noise levels in the consent.*

Low frequency noise is assessed under the *NSW Noise Policy for Industry* (NPfI) methodology following its introduction in 2017, and replaces the INP methodology. A full L_{Ceq} minus L_{Aeq} and, if required, low frequency 1/3 octave analysis of SMC noise contributions was conducted at the following locations:

- Atkins - Day

At all other locations weather conditions were either outside of the consented conditions, SMC was not audible and/or significantly below the relevant noise criteria and is therefore not addressed further. The results of the operator attended noise measurements presented in **Section 4**.

3 Operational Noise Monitoring Methodology

3.1 General Requirements

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS IEC 61672.1 – 2004 *Electroacoustics—Sound level meters – Specifications*, AS IEC 61672.2-2004, AS IEC 61672.3-2004 and carried current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

All operator-attended noise measurements were conducted using a one-third octave integrating Brüel & Kjær Type 2250L (s/n 3003389) together with a Svantek SV30A acoustical calibrator (s/n 39482).

3.2 Operator-attended Noise Monitoring Locations

Noise monitoring was conducted in accordance with the requirements of the NMP.

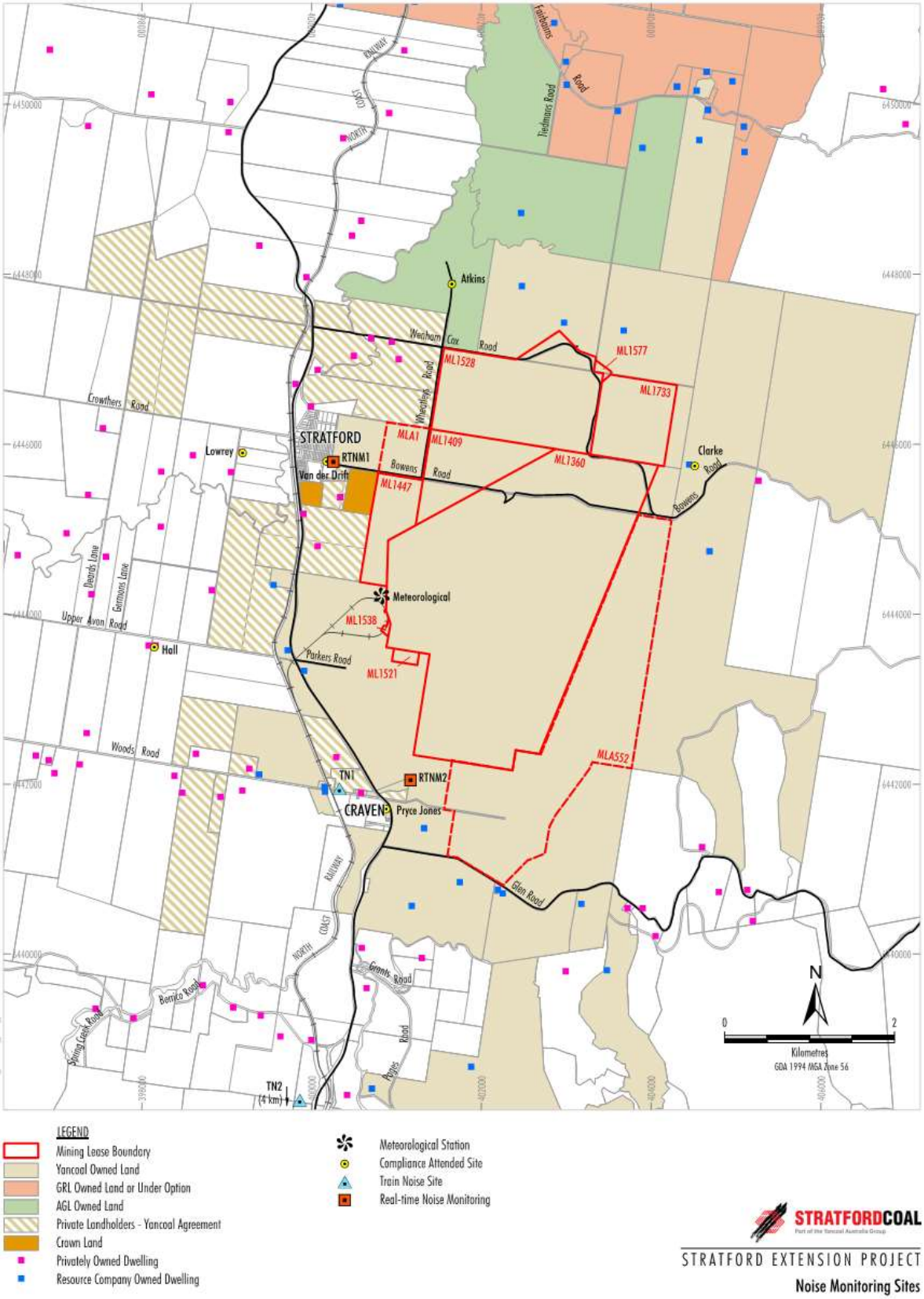
Operator-attended noise measurements were conducted during the day, evening and night-time period for a minimum of 15 minutes per period at each of the six nominated residential noise monitoring locations. The details of the operator-attended SMC operational noise monitoring locations are contained within **Table 3** and shown generally in **Figure 1**. During the operator-attended noise measurements, the character and relative contribution of ambient noise sources and SMC contributions were determined by observations on site.

Table 3 SMC Operational Noise Monitoring Locations

Monitoring Location	Receiver Type	Resident / Owner	Monitoring Location - MGA Zone 56	
			Easting (m)	Northing (m)
Atkins	Residence	Atkins	401544	6447134
Clarke	Residence	Clarke	404406	6445783
Hall	Residence	Hall	398269	6443709
Lowrey	Residence	Lowrey	399193	6445879
Pryce Jones	Residence	Pryce Jones	400807	6441846
Van der Drift	Residence	Van der Drift	400171	6445775

The objective of the SMC operational operator-attended noise monitoring was to measure the maximum (L_{Amax}) and the $L_{Aeq(15minute)}$ noise level contributions at the nearest potentially affected receptors to determine the noise contribution of mining activities associated with SMC operations over a 15 minute measurement period. During the measurement, the operator also quantifies and characterises the overall levels of ambient noise in the area (i.e. L_{Amax}, L_{A1}, L_{A10}, L_{A90}, and L_{Aeq}) over the 15 minute measurement interval.

Figure 1 Stratford Mining Complex Attended Noise Monitoring Locations



Source: NMP

4 Results

4.1 Operator-attended Noise Monitoring - SMC Operational Activity

Operator-attended noise measurements were conducted during a day, evening and night period between Thursday 26 September and Friday 27 September 2019. Results of the operator-attended noise surveys at residential locations are provided in **Sections 4.1.1** to **4.1.6**

A summary of the results for the attended noise monitoring are displayed graphically in **Appendix B** showing L_{Amax}, L_{Aeq}, and $L_{Aeq(<1.25kHz)}$ in 1-second intervals throughout the monitoring survey.

Ambient noise levels presented include all noise sources such as transport (roads, rail and aircraft), fauna (insects, frogs, birds, and bats), farm animals (cows, bulls), the natural environment (wind, wind in trees), domestic noises, other industrial operations as well as SMC noise emissions.

Weather data during the monitoring period has been obtained from the weather station located on the SMC site.

The tables provide the following information:

- Date and start time, operator and equipment details.
- Monitoring location.
- Wind velocity (m/s) and temperature (ºC) at the measurement location.
- Typical maximum (L_{Amax}) and contributed $L_{Aeq(15minute)}$ noise levels.

4.1.1 Operator-attended Noise Survey Results – 'Atkins'

Results of the operator-attended noise surveys at 'Atkins' are provided in **Table 4**. Monitoring location 'Atkins' represents residential receptors located to the north of the site.

Table 4 Operator-attended Noise Survey Results - 'Atkins'

Atkins	Date/Start Time/ Weather	Primary Noise Descriptor dBA (15 minute)						Description of Noise Emissions and Typical Maximum Noise Levels (dBA)
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	L_{Aeq} (≤1.25kHz)	
Day	26/09/2019 16:53 20°C 2.4 m/s E	54	46	41	33	38	37	*Site related noise events:* **SMC: Audible** General mining operations 33-36 **$L_{Aeq(15minute)}$ contribution 34 dBA** *Other noise events:* Birds 45-54 Wind 35-46
Evening	26/09/2019 21:15 13°C 1.9 m/s W	53	40	33	23	30	29	*Site related noise events:* **SMC: Briefly Audible** Haul Trucks 33-38 **$L_{Aeq(15minute)}$ contribution 29 dBA** *Other noise events:* Cows 49-53 Owl 24
Night	27/09/2019 00:04 13°C 2.1 m/s NE	41	36	29	22	27	25	*Site related noise events:* **SMC: Briefly Audible** Haul Trucks 26-32 **$L_{Aeq(15minute)}$ contribution 25 dBA** **L_{Amax} contribution 32 dBA** *Other noise events:* Cows 35-41 Generator 22-25

SMC operations were audible during the all operator-attended surveys at this location. SMC operations generated an $L_{Aeq(15minute)}$ noise contribution of 34 dBA, 29 dBA and 25 dBA during the day, evening and night-time respectively. During the night time period haul trucks generated L_{Amax} noise levels of 32 dBA at the monitoring location.

It was noted during the day period measurement that SMC noise contributions were dominant and that L_{Ceq} was more than 15 dB above the L_{Aeq} and therefore triggers a more detailed assessment of low frequency noise. **Table 5** details the 1/3 octave SMC contribution assessed against the NPfI low frequency threshold.

Table 5 Atkins Day – NPfI Low Frequency Analysis

Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
$L_{Zeq(15minute)}$ threshold Level dBZ	92	89	86	77	69	61	54	50	50	48	48	46	44
SMC $L_{Zeq(15minute)}$ noise level	-	69	63	58	54	54	54	48	44	43	40	36	34
Exceedance	-	-	-	-	-	-	-	-	-	-	-	-	-

Based on the comparison in **Table 5** SMC noise did not exceed the NPfI threshold level in the any 1/3 octave band. As such no positive adjustment to the measured noise level is to be applied.

4.1.2 Operator-attended Noise Survey Results - 'Clarke'

Results of the operator-attended noise surveys at 'Clarke' are provided in **Table 6**. Monitoring location 'Clarke' represents residential receptors located to the east of the site, and is a SMC owned property. The monitoring results at Clarke are used to determine SMC contributions at the 'Bagnall' residence located further to the east.

Table 6 Operator-attended Noise Survey Results - 'Clarke'

Clarke	Date/Start Time/ Weather	Primary Noise Descriptor dBA (15 minute)						Description of Noise Emissions and Typical Maximum Noise Levels (dBA)
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	L_{Aeq} (≤1.25kHz)	
Day	26/09/2019 17:15 20°C 2.9 m/s E	65	50	42	34	40	39	*Site related noise events:* **SMC: Not Measureable** *Other noise events:* Wind 36-51 Birds 48-65
Evening	26/09/2019 20:52 14°C 0.6 m/s N	59	40	29	19	28	27	*Site related noise events:* **SMC: Audible** General mining operations 20-28 **$L_{Aeq(15minute)}$ contribution 23 dBA** *Other noise events:* Birds 42-59
Night	26/09/2019 23:38 13°C 1.4 m/s NNE	55	49	46	42	44	44	*Site related noise events:* **SMC: Audible** Dozers 48-51 General mining operations 42-46 **$L_{Aeq(15minute)}$ contribution 44 dBA** **L_{Amax} contribution 51 dBA** *Other noise events:* Operator 55

SMC operations were not measureable during the day and audible during the evening and night-time operator-attended surveys. SMC operations generated an $L_{Aeq(15minute)}$ noise contribution of 23 dBA and 44 dBA during the evening and night-time respectively. During the night time period the operation of the pit generated L_{Amax} noise levels of up to 51 dBA at the monitoring location.

Taking into account the distance between the observed SMC operations and the nearest privately owned residence Bagnall, $L_{Aeq(15minute)}$ noise levels of <20 dBA during the evening and 37 dBA during the night-time are predicted at the Bagnall location. L_{Amax} noise levels are predicted to be 44 dBA. This figure is considered to be conservative as it takes into account corrections for propagation distance only (i.e. no shielding due to topography or atmospheric absorption). SMC operations are predicted to be compliant at the Bagnall location.

4.1.3 Operator-attended Noise Survey Results - 'Hall'

Results of the operator-attended noise surveys at 'Hall' are provided in **Table 7.** Monitoring location 'Hall' represents residential receptors located to the southwest of the site.

Table 7 Operator-attended Noise Survey Results - 'Hall'

Hall	Date/Start Time/ Weather	Primary Noise Descriptor dBA (15 minute)						Description of Noise Emissions and Typical Maximum Noise Levels (dBA)
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	L_{Aeq} (≤1.25kHz)	
Day	26/09/2019 15:18 22°C 3.6 m/s SE	79	66	46	35	55	54	*Site related noise events:* **SMC: Not Measureable** *Other noise events:* Road traffic 46-79 Birds 39-50 Plane 40-45
Evening	26/09/2019 19:40 16°C 1.7 m/s N	47	41	36	28	33	32	*Site related noise events:* **SMC: Audible** General mining operations 26-29 **$L_{Aeq(15minute)}$ contribution 28 dBA** *Other noise events:* Road traffic 34-47 Insects 27-29
Night	26/09/2019 22:21 13°C 1.4 m/s NE	56	35	28	21	26	24	*Site related noise events:* **SMC: Inaudible** *Other noise events:* Road traffic 40-56 Insects 23

SMC operations were not measureable during the day, audible during the evening and inaudible during the night-time operator attended noise surveys at this location. SMC operations generated an $L_{Aeq(15minute)}$ noise contribution of 28 dBA during the evening survey period.

4.1.4 Operator-attended Noise Survey Results - 'Lowrey'

Results of the operator-attended noise surveys at 'Lowrey' are provided in **Table 8**. Monitoring location 'Lowrey' represents residential receptors located to the west of the site and west of Bucketts Way.

Table 8 Attended Noise Survey Results - 'Lowrey'

Lowrey	Date/Start Time/ Weather	Primary Noise Descriptor dBA (15 minute)						Description of Noise Emissions and Typical Maximum Noise Levels (dBA)
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	L_{Aeq} (≤1.25kHz)	
Day	26/09/2019 16:30 21°C 2 m/s ESE	62	54	45	35	43	41	*Site related noise events:* **SMC: Inaudible** *Other noise events:* Road traffic 42-48 Cattle 50-62 Birds 36-41
Evening	26/09/2019 20:25 14°C 1.1 m/s NNW	47	45	41	24	36	27	*Site related noise events:* **SMC: Barely Audible** General mining operations 21-24 **$L_{Aeq(15minute)}$ contribution 22 dBA** *Other noise events:* Road traffic 28-35 Insects 25 Cows 46-47
Night	26/09/2019 23:08 13°C 1.4 m/s NE	55	50	33	19	36	35	*Site related noise events:* **SMC: Inaudible** *Other noise events:* Road traffic noise 45-55 Frogs / insects 20-23

SMC operations were barely audible during the evening and inaudible during the day and night-time periods at this location. SMC operations generated an $L_{Aeq(15minute)}$ noise contribution of 22 dBA during the evening survey period.

4.1.5 Operator-attended Noise Survey Results - 'Pryce-Jones'

Results of the operator-attended noise surveys at 'Pryce Jones' are provided in **Table 9.** Monitoring location 'Pryce Jones' represents residential receptors located in Craven to the south of the site.

Table 9 Attended Noise Survey Results – 'Pryce Jones'

Pryce-Jones	Date/Start Time/ Weather	Primary Noise Descriptor dBA (15 minute)						Description of Noise Emissions and Typical Maximum Noise Levels (dBA)
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	L_{Aeq} (≤1.25kHz)	
Day	26/09/2019 14:52 23°C 4.3 m/s ESE	70	65	56	35	52	51	*Site related noise events:* **SMC: Inaudible** *Other noise events:* Road traffic 42-70 Birds 34-40
Evening	26/09/2019 19:17 16°C 1.2 m/s NNW	67	63	49	32	49	47	*Site related noise events:* **SMC: Inaudible** *Other noise events:* Road traffic 39-67
Night	26/09/2019 22:00 13°C 1.2 m/s NE	67	59	45	31	45	44	*Site related noise events:* **SMC: Audible** **$L_{Aeq(15minute)}$ contribution 31 dBA** **L_{Amax} contribution 33 dBA** *Other noise events:* Road traffic 42-67 Insects 29

SMC operations were inaudible during the day and evening and audible throughout the night-time period survey at this location. The SMC generated $L_{Aeq(15minute)}$ noise contributions of 31 dBA during the night-time. During the night-time period SMC operations generated L_{Amax} noise levels of 33 dBA.

4.1.6 Operator-attended Noise Survey Results – 'Van der Drift'

Results of the operator-attended noise surveys at 'Van der Drift' are provided in **Table 10.**

Table 10 Attended Noise Survey Results – 'Van der Drift'

Van der Drift	Date/Start Time/ Weather	Primary Noise Descriptor dBA (15 minute)						Description of Noise Emissions and Typical Maximum Noise Levels (dBA)
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	L_{Aeq} (≤1.25kHz)	
Day	26/09/2019 15:43 21°C 3.6 m/s ESE	56	45	41	34	38	36	*Site related noise events:* **SMC: Audible** General mining operations 31-34 **$L_{Aeq(15minute)}$ contribution 33 dBA** *Other noise events:* Road traffic 43-56 Birds 39-50
Evening	26/09/2019 20:02 15°C 2.1 m/s NNW	63	56	41	27	42	40	*Site related noise events:* **SMC: Audible** General mining operations 27-30 **$L_{Aeq(15minute)}$ contribution 29 dBA** *Other noise events:* Road traffic 35-63 Dogs 48 Insects 27
Night	26/09/2019 22:45 13°C 1.7 m/s NE	51	38	32	22	29	27	*Site related noise events:* **SMC: Barely Audible** **$L_{Aeq(15minute)}$ Contribution22 dBA** **L_{Amax} Contribution 24 dBA** *Other noise events:* Road traffic 38-51 Frogs / insects 22-25

SMC operations were audible during the day and evening but barely audible during the night-time operator attended noise surveys at this location. SMC operations generated $L_{Aeq(15minute)}$ noise levels of 33 dBA, 29 dBA and 22 dBA during the day, evening and night-time periods respectively. L_{Amax} noise levels of 24 dBA from haul trucks were measured during the night-time survey.

4.2 RTNM Verification Monitoring

Results of the operator-attended noise surveys at 'RTNM1' and 'RTNM2' are provided in **Table 11**.

Table 11 Attended Noise Survey Results - Real Time Noise Monitoring Locations

Location and Period	Date/Start Time/ Weather	Primary Noise Descriptor dBA (15 minute)						Description of Noise Emissions and Typical Maximum Noise Levels (dBA)
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	L_{Aeq} (≤1.25kHz)	
RTNM1 Day	26/09/2019 16:05 21°C 3.1 m/s ESE	69	51	40	34	41	35	*Site related noise events:* **SMC: Audible** General mining operations 34-42 **LAeq(15minute) contribution 36 dBA** *Other noise events:* Wind 38-43 Birds 42-69
RTNM2 Day	30/09/2019 13:56 22°C 4.6 m/s ESE	58	55	51	40	48	45	*Site related noise events:* **SMC: Inaudible** *Other noise events:* Wind 39-48 Birds 43-58 Road construction 37

4.3 Rail Noise Monitoring

SMC rail pass-by noise levels are presented in **Table 12**.

Table 12 Operator-attended Rail Noise Monitoring Results

Monitoring Location	Date and Time	L_{Amax} (dBA)	
		Horn Included	Horn Excluded
TN1	30/09/2019 4:20 PM	73	69
TN2	27/09/2019 12:01PM	-[1]	82

Note 1: Horn was not sounded.

Maximum SMC rail pass-by were below 85 dBA L_{Amax} at both locations, including the sounding of the horn on the approach to the level crossing at TN1.

5 Performance Assessment

5.1 Operations

Results of the operator-attended noise measurements compared with the relevant noise criteria contained in the SMC Development Consent are given in **Table 13**.

Table 13 Performance Assessment – Operations

	Estimated SMC $L_{Aeq(15minute)}$ Noise Level dBA[1]			Noise Criteria $L_{Aeq(15minute)}$ dBA			Compliance		
	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
Atkins	34	29	25	35	35	35	Yes	Yes	Yes
Clarke[3]	N/M[1]	23	44	37	37	37	N/A[5]	N/A[5]	N/A[5]
Bagnall[4]	N/M	<20	37	37	37	37	Yes	Yes	Yes
Hall	N/M	28	I/A[2]	35	35	35	Yes	Yes	Yes
Lowrey	I/A	22	I/A	35	35	35	Yes	Yes	Yes
Pryce Jones	I/A	I/A	31	43	43	43	Yes	Yes	Yes
Van der Drift	33	29	22	37	36	35	Yes	Yes	Yes

Note 1: N/M = Not Measureable.

Note 2: I/A = Inaudible.

Note 3: Owned by Stratford Coal Pty Ltd. Criteria adopted from Bagnall.

Note 4: Modelled result.

Note 5: Criteria adopted as a guide only.

Results presented in **Table 13** indicate that SMC operations during the operator-attended noise monitoring at all privately owned locations under applicable weather conditions were compliant with the relevant Development Consent conditions. Noise levels at Clarke were above the adopted noise criteria, however the Clarke property is owned by Stratford Coal Pty Ltd.

5.2 Sleep Disturbance

Results of the night period sleep disturbance measurements compared with the relevant noise criteria contained in the Development Consent are given in **Table 14.**

Table 14 Performance Assessment – Sleep Disturbance

Location	SMC $L_{A1(1minute)}$ Contribution	Noise Criteria $L_{A1(1minute)}$	Compliance
Atkins	32	45	Yes
Clarke[2]	51	45	N/A[4,5]
Bagnall[3]	44	45	N/A[5]
Hall	I/A	45	Yes
Lowrey	I/A	45	Yes
Pryce Jones	33	49	Yes
Van der Drift	24	45	Yes

Note 1: I/A = Inaudible.

Note 2: Owned by Stratford Coal Pty Ltd. Criteria adopted from Bagnall.

Note 3: Modelled result.

Note 4: Criteria adopted as a guide only.

Note 5: Criteria not applicable due to weather conditions outside meteorological conditions detailed in SSD-4966.

Table 14 indicate that SMC operations during the night-time operator-attended noise monitoring at all privately owned locations under applicable weather conditions were compliant with the relevant Development Consent conditions.

6 Conclusion

SLR was engaged by Stratford Coal Pty Limited to conduct monthly noise monitoring for the Stratford Mining Complex (SMC) operations guided by the requirements of the *Stratford Mining Complex Noise Management Plan* (NMP), Document No. NMP-R03-A, dated 17 June 2019.

Operator-attended noise monitoring was conducted at six residential receiver locations, the RTNM locations and rail noise monitoring locations commencing Thursday 26 September 2019 and concluding Monday 30 September 2019 in order to determine the noise performance of the SMC operations against the Development Consent conditions.

Based on the measured SMC noise contribution, compliance with the relevant operational noise criteria was achieved at all noise monitoring locations during the day, evening and night monitoring periods

Based on the measured SMC noise contribution, compliance with the relevant sleep disturbance noise criteria was achieved at all privately owned noise monitoring locations during the night-time noise monitoring period under applicable weather conditions.

APPENDIX A

Acoustic Terminology

1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2. 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

3. Sound Power Level

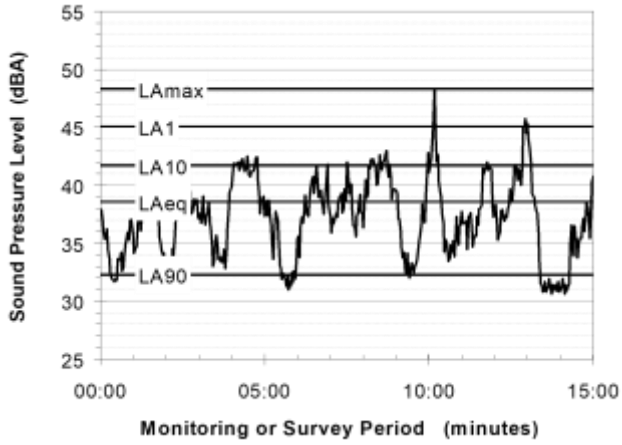
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

5. Frequency Analysis

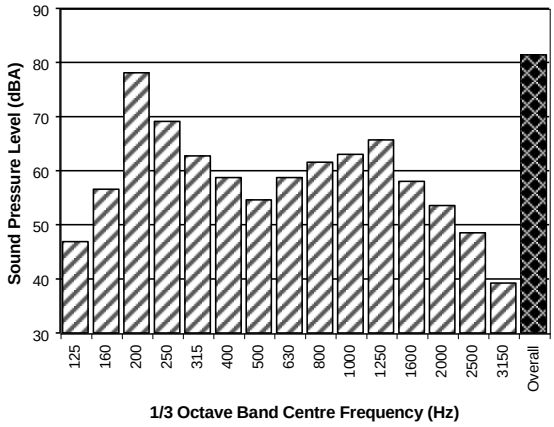
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

APPENDIX B

Operator Attended Noise Survey Charts

Figure B1 – Day Period – 'Atkins' Operator Attended Noise Survey Results

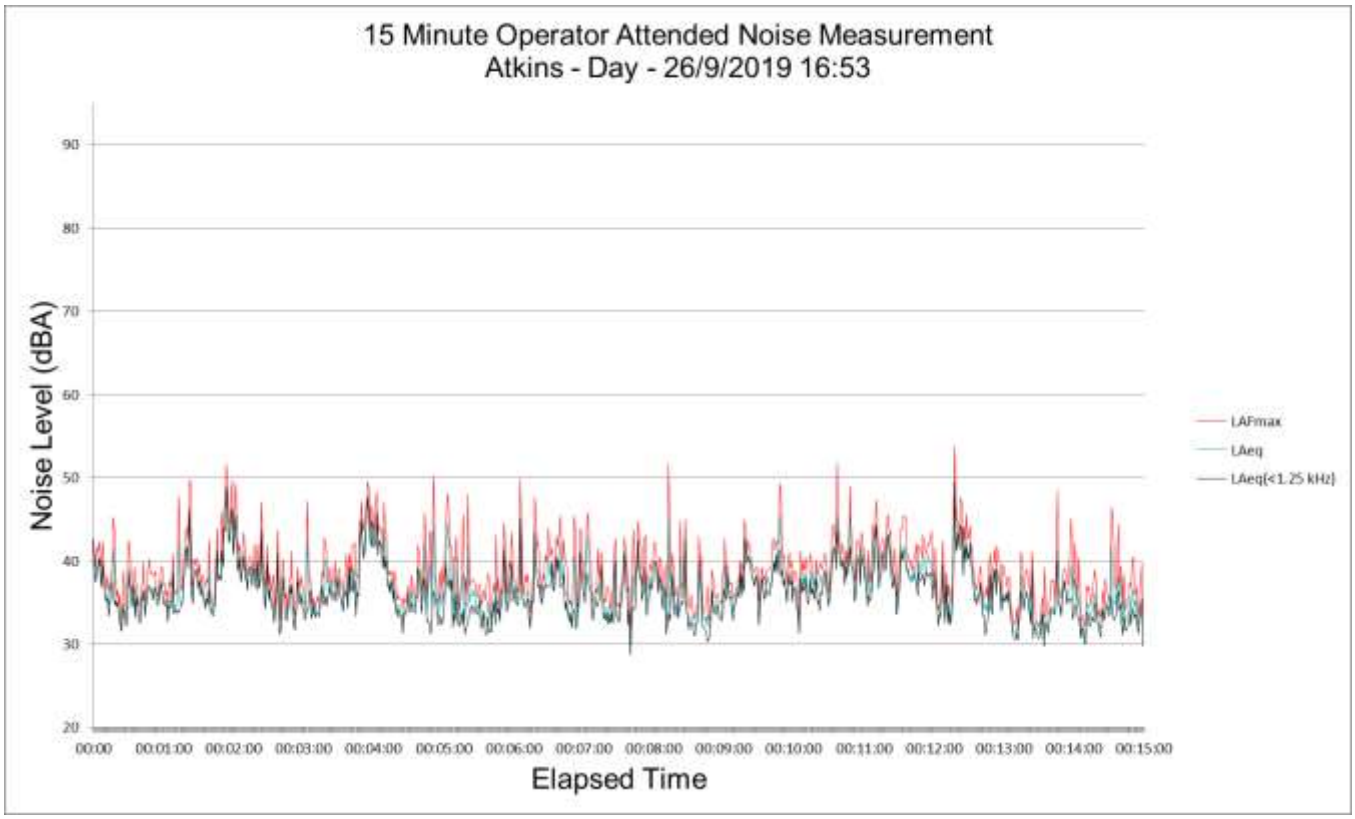


Figure B2 – Evening Period – 'Atkins' Operator Attended Noise Survey Results

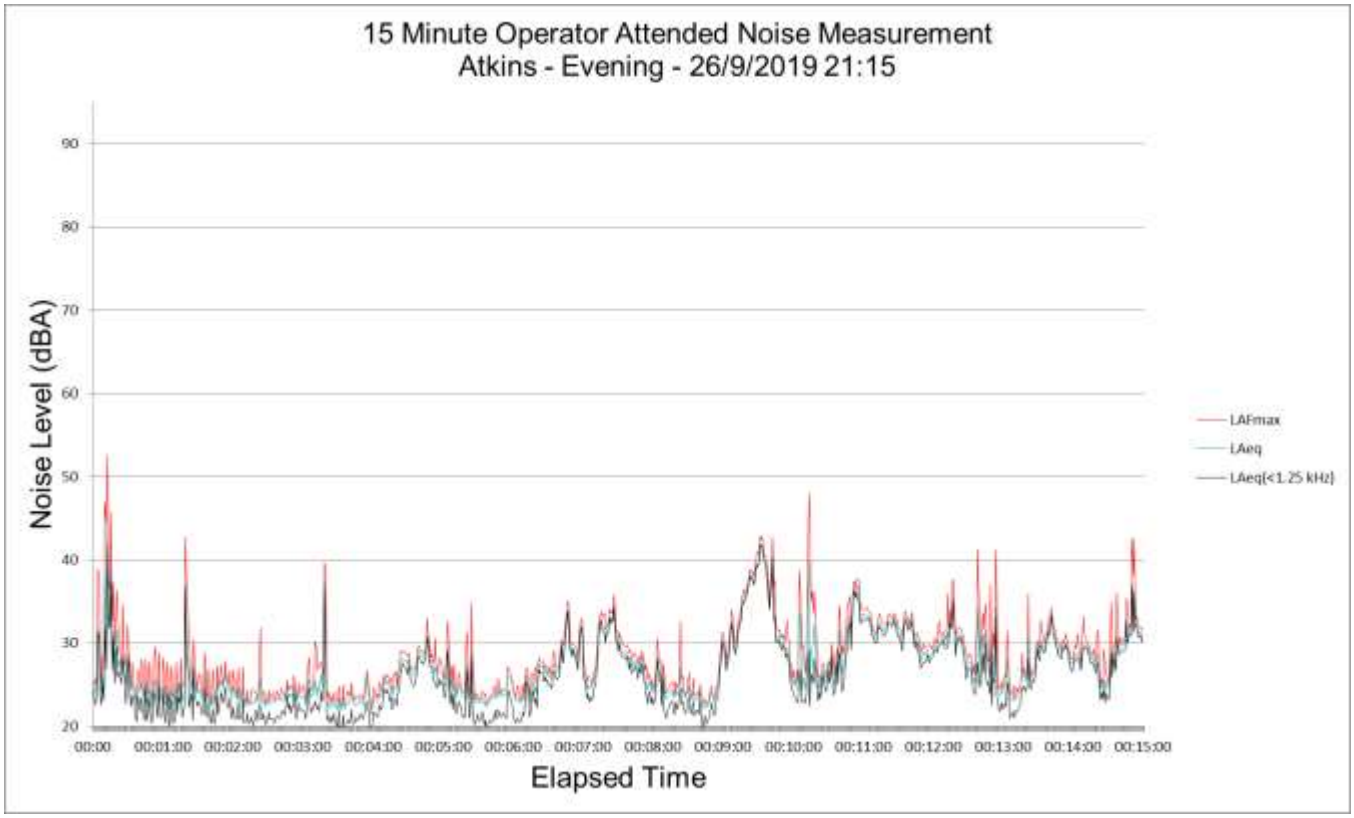


Figure B3 – Night Period – 'Atkins' Operator Attended Noise Survey Results

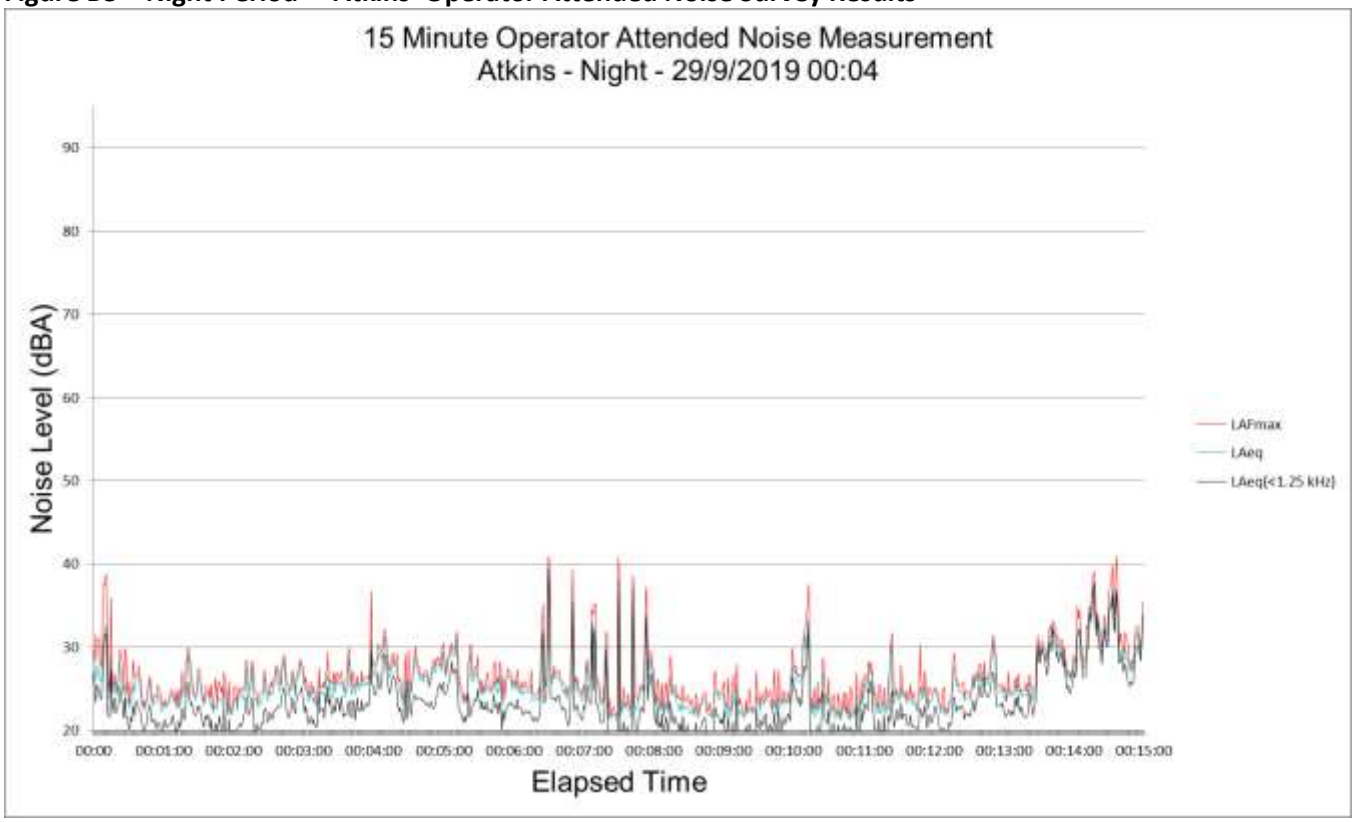


Figure B4 – Day Period – 'Clarke' Operator Attended Noise Survey Results

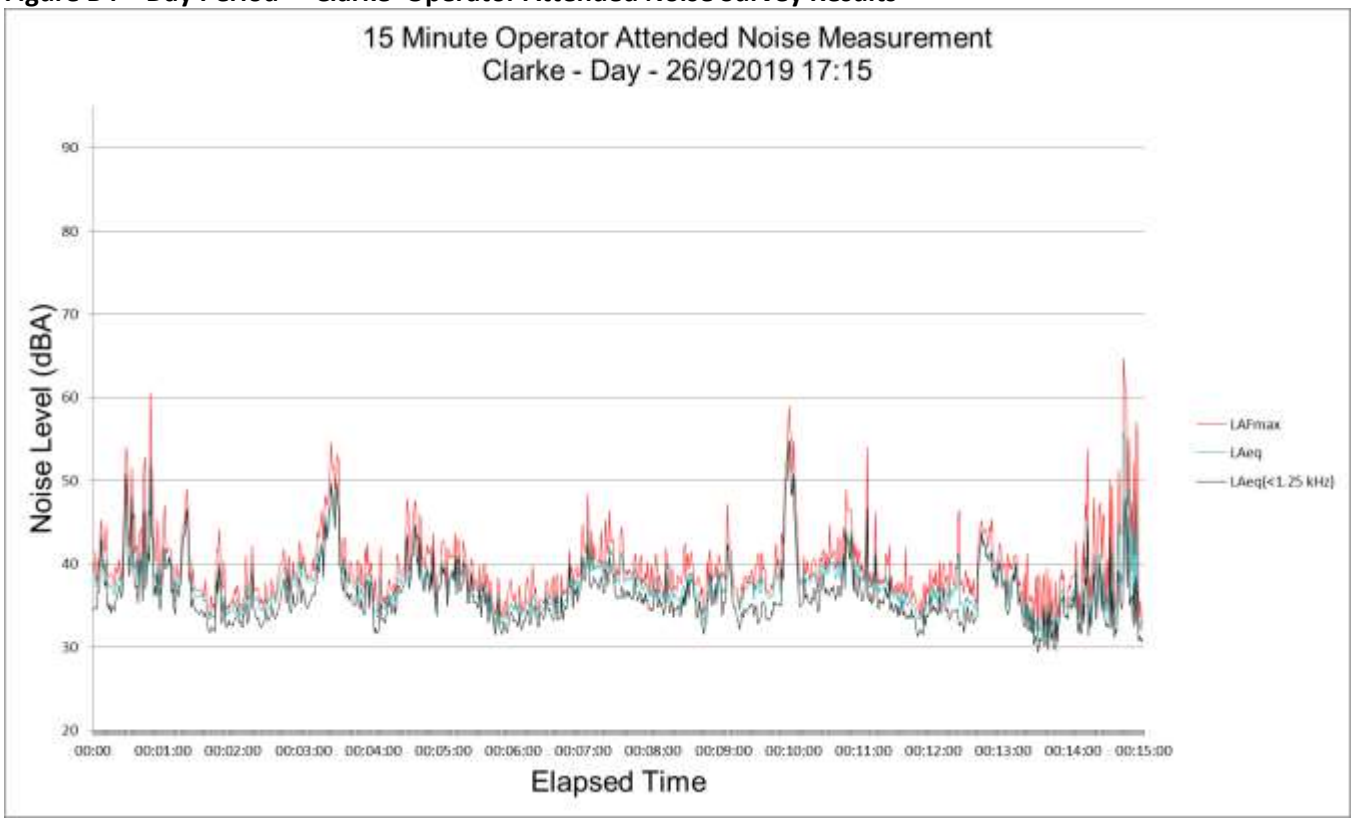


Figure B5 – Evening Period – 'Clarke' Operator Attended Noise Survey Results

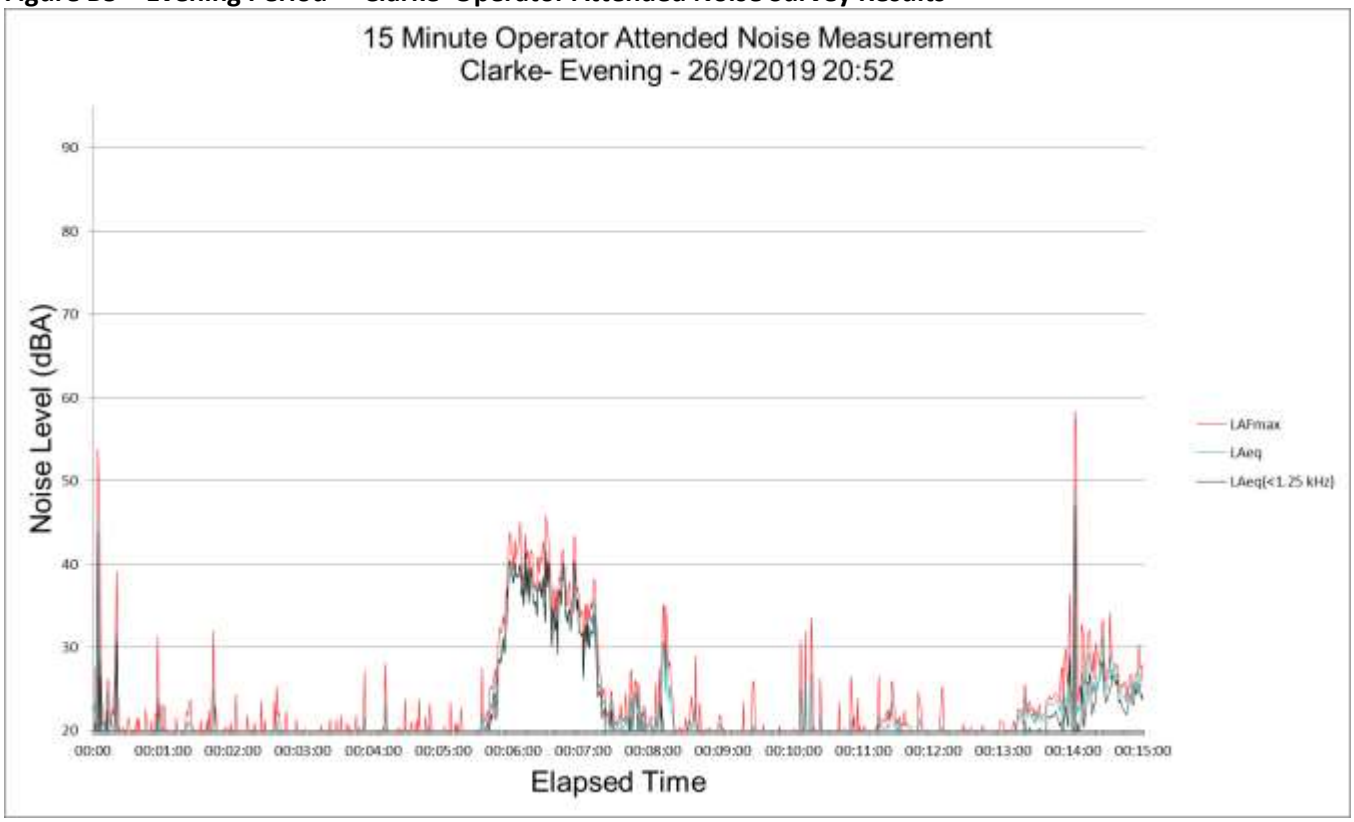


Figure B6 – Night Period – 'Clarke' Operator Attended Noise Survey Results

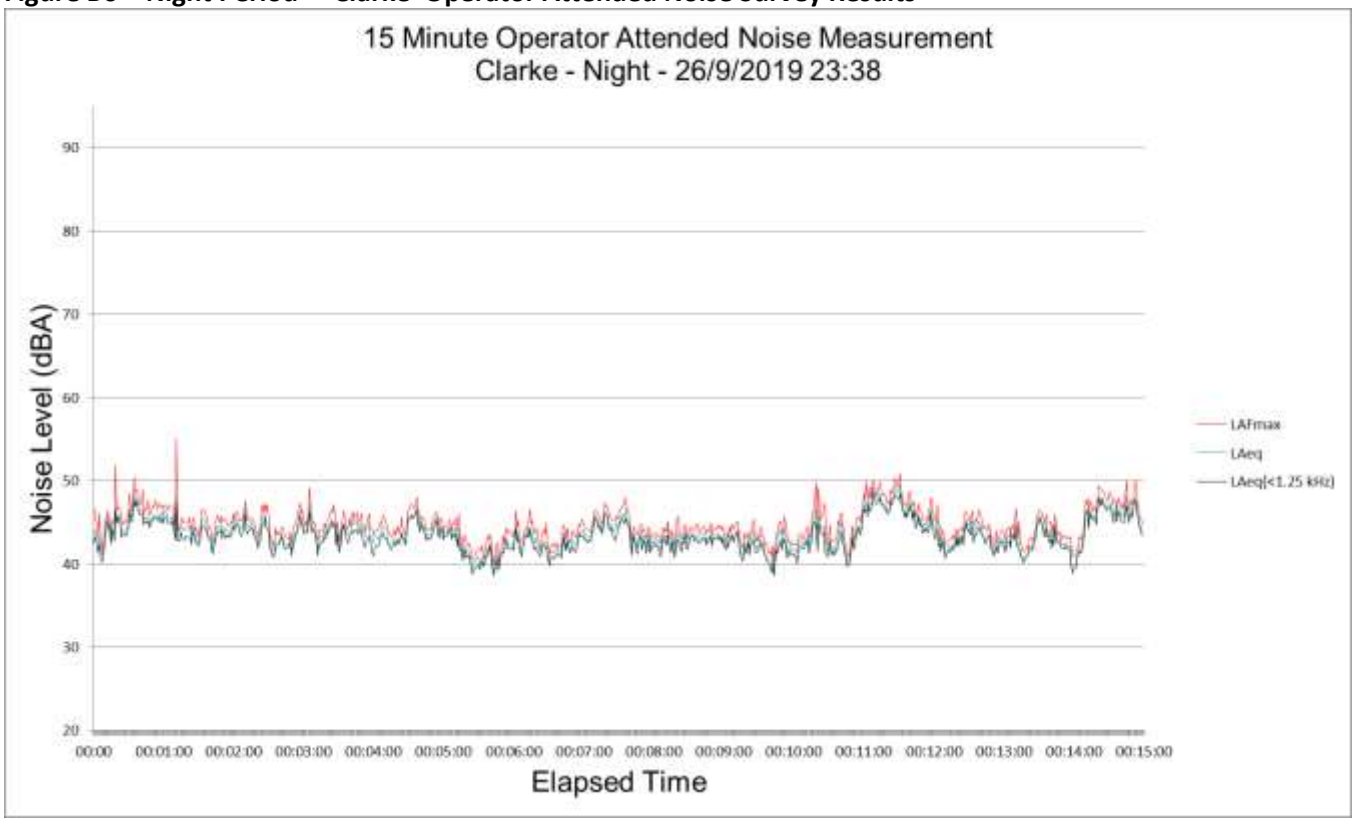


Figure B7 – Day Period – 'Hall' Operator Attended Noise Survey Results

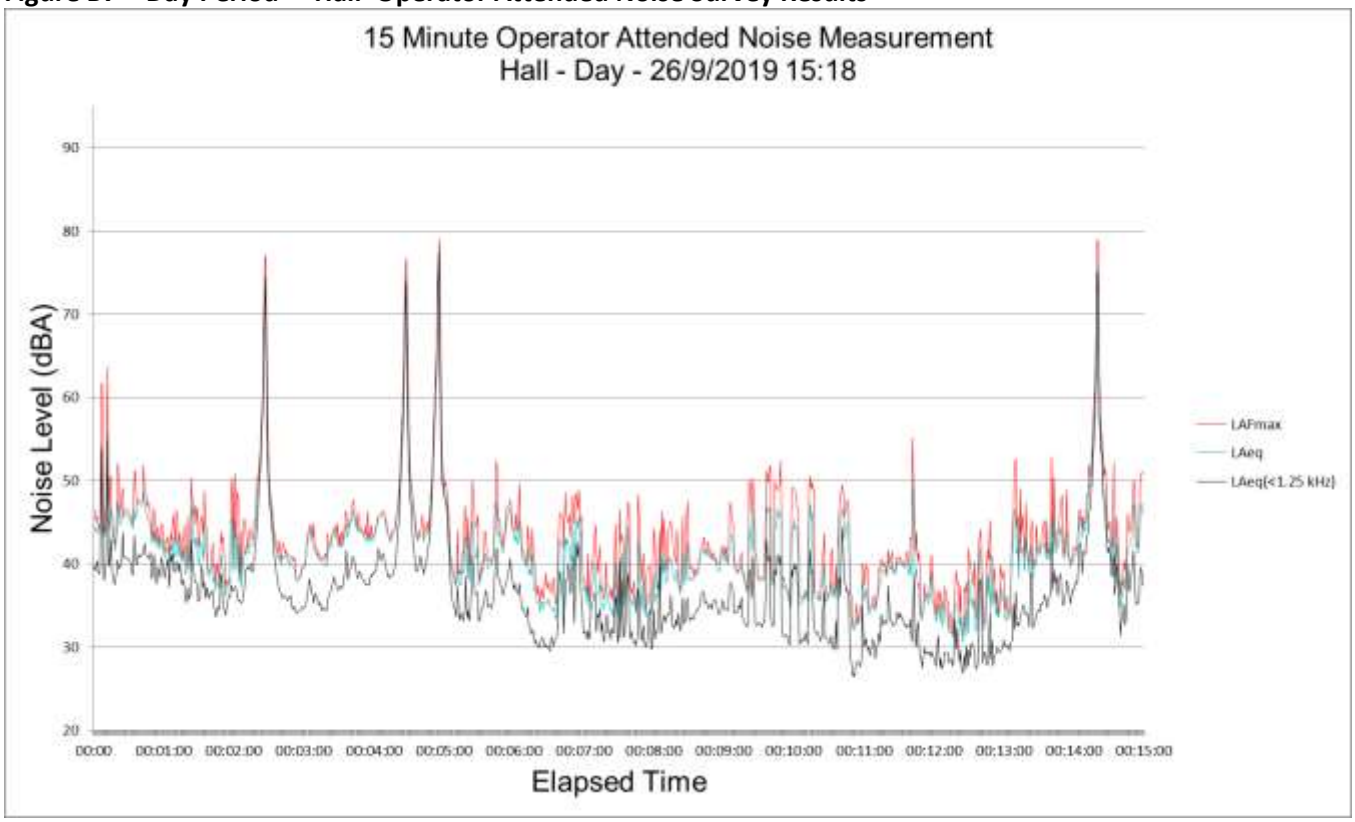


Figure B8 – Evening Period – 'Hall' Operator Attended Noise Survey Results

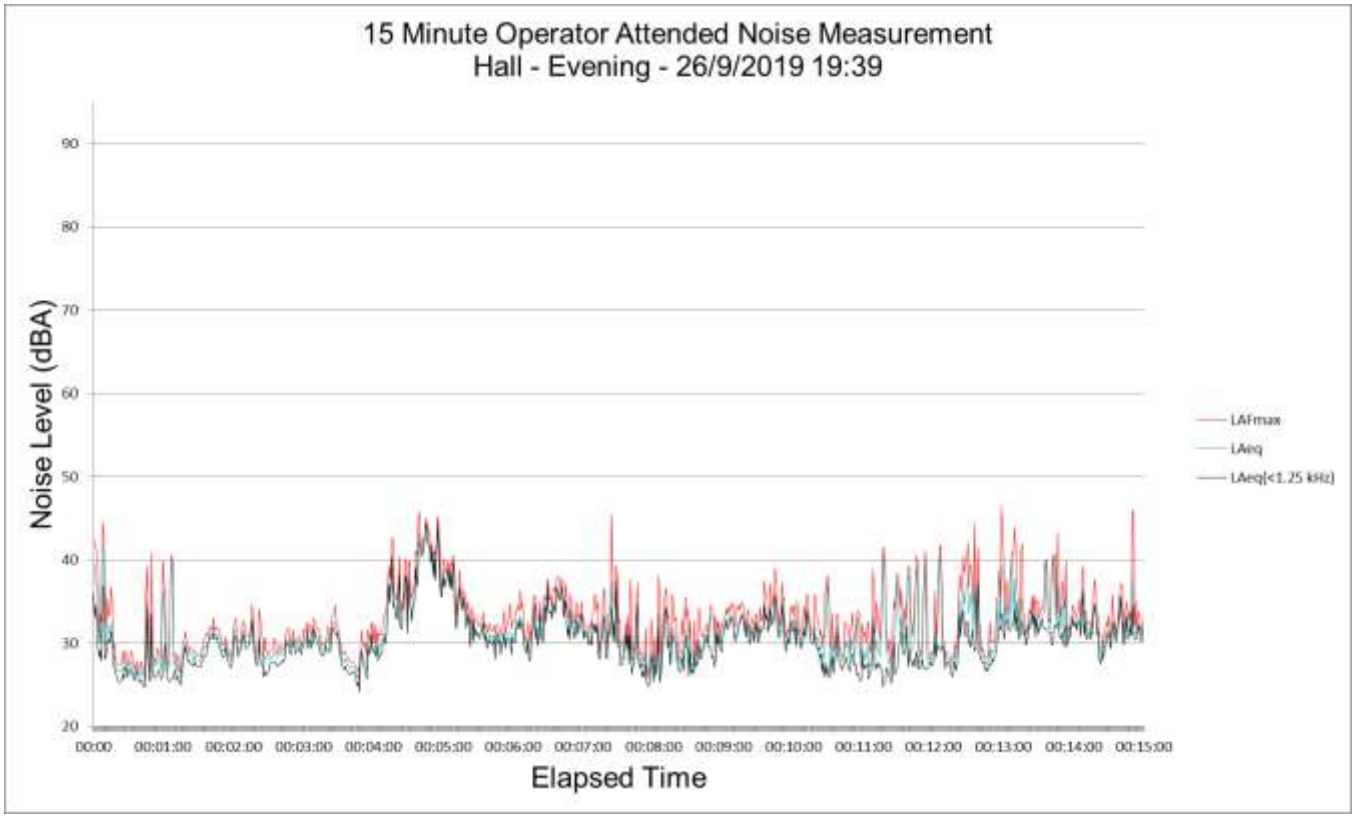


Figure B9 – Night Period – 'Hall' Operator Attended Noise Survey Results

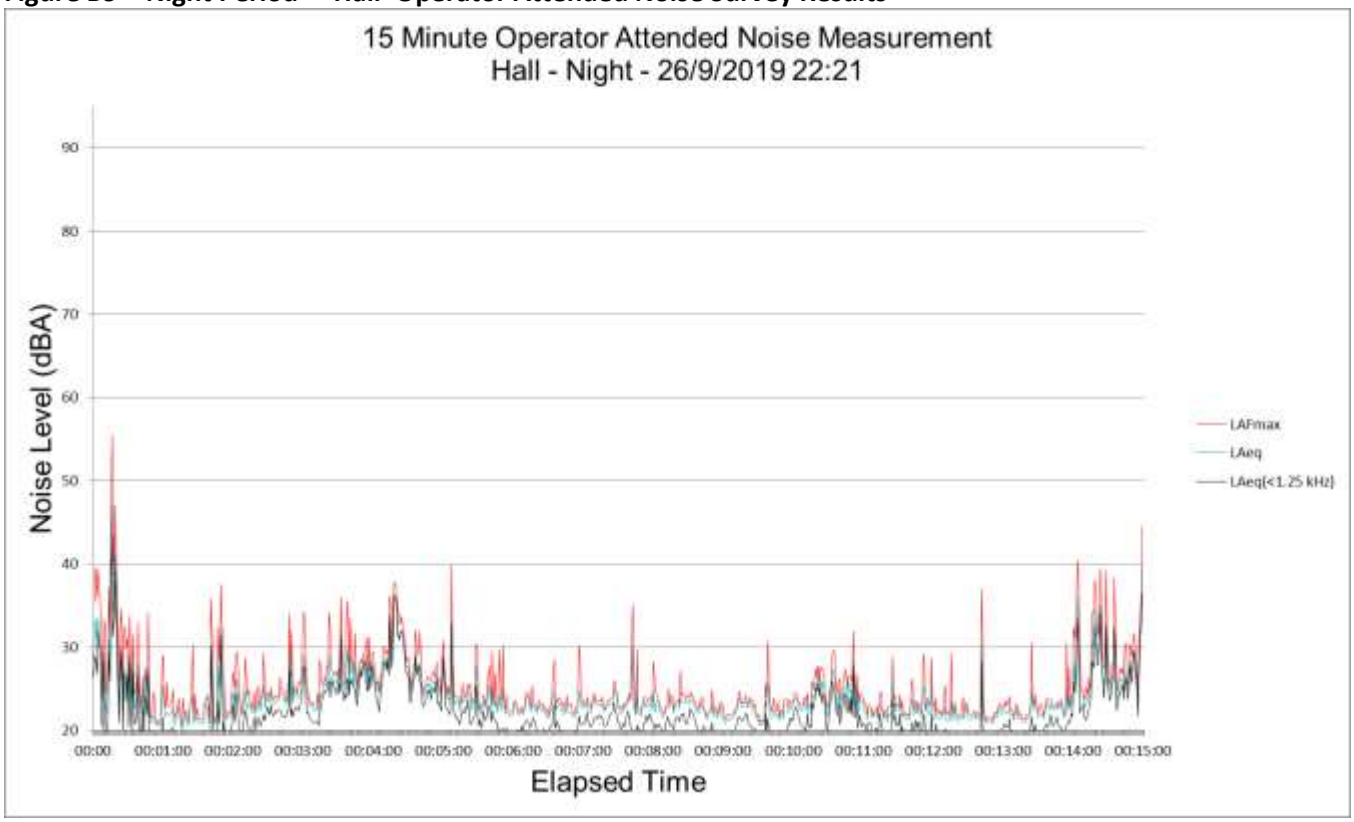


Figure B10 – Day Period – 'Lowrey' Operator Attended Noise Survey Results

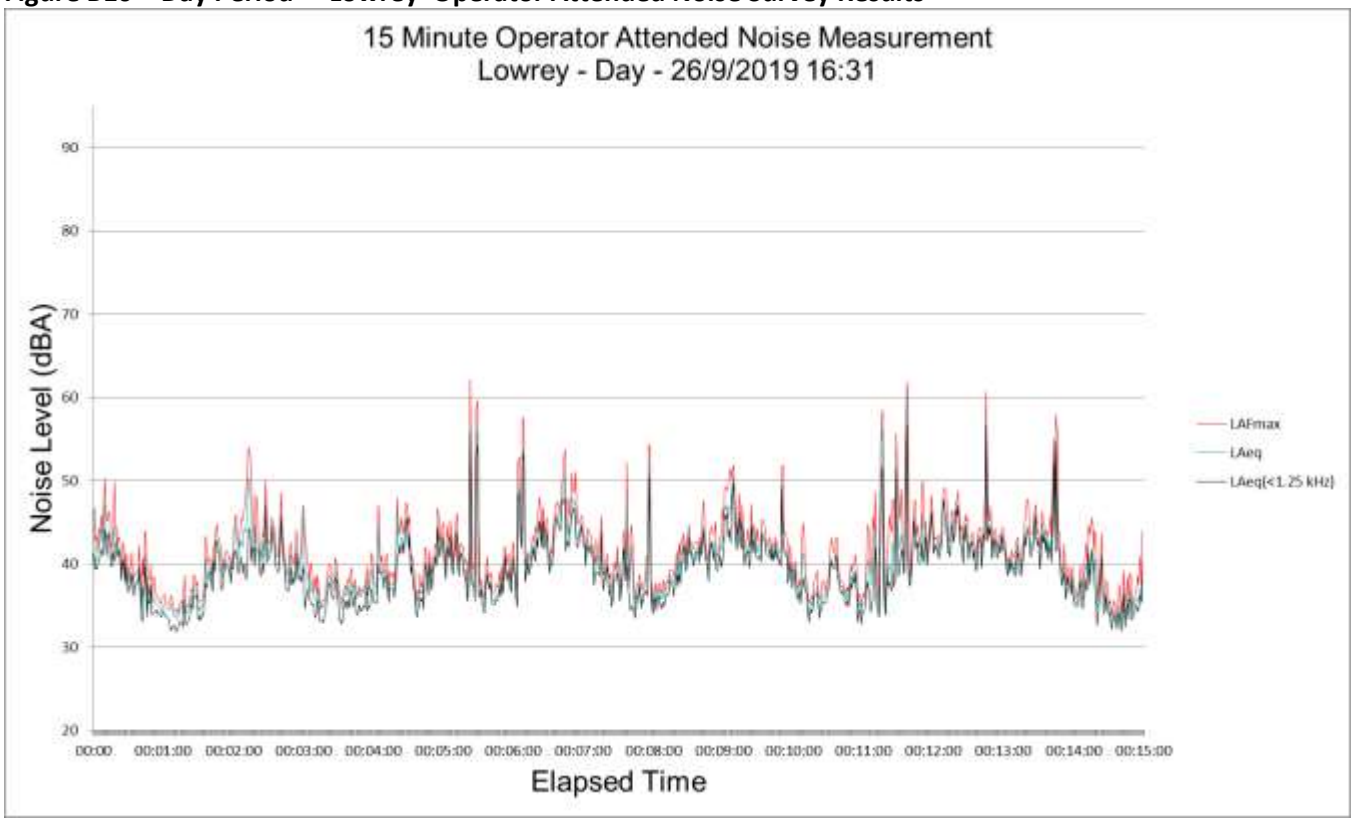


Figure B11 – Evening Period – 'Lowrey' Operator Attended Noise Survey Results

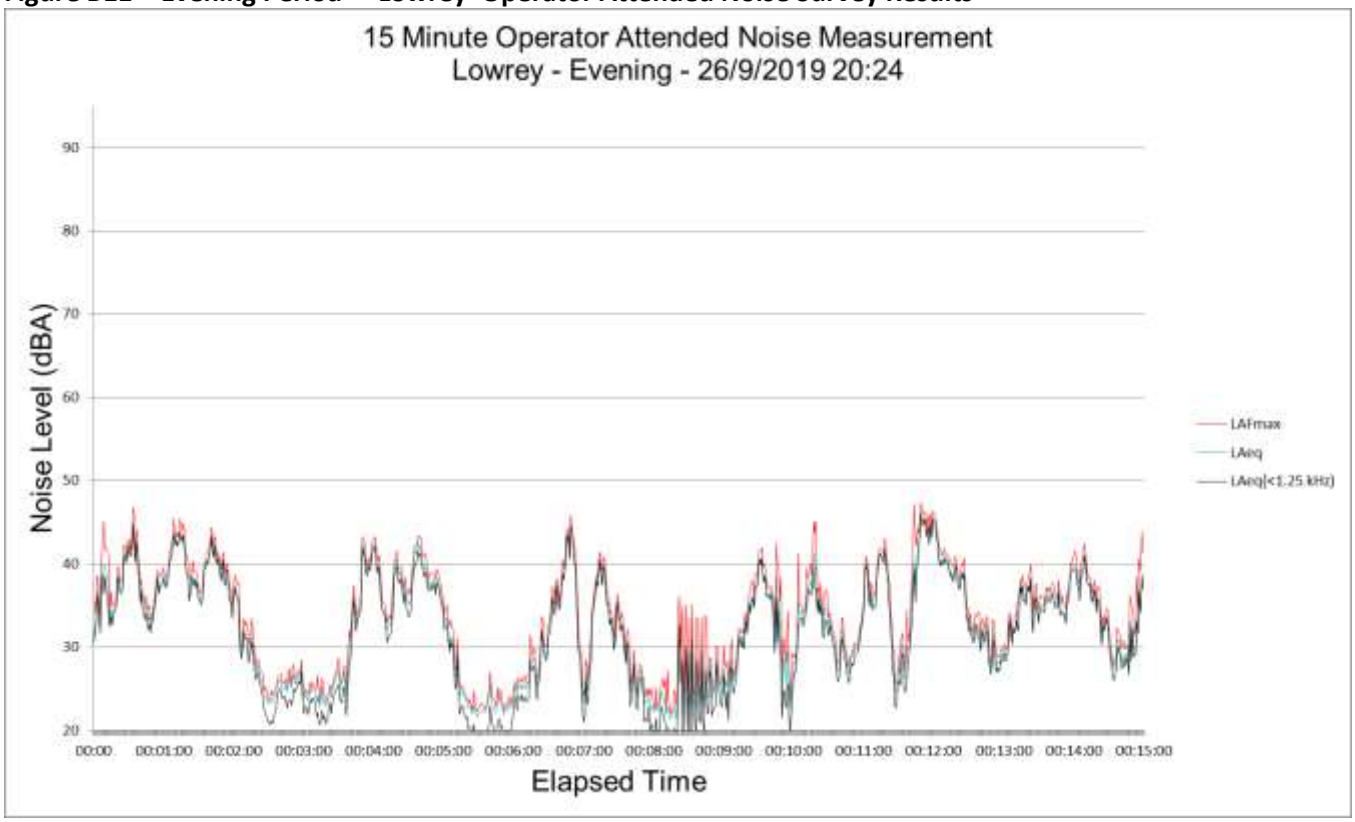


Figure B12 – Night Period – 'Lowrey' Operator Attended Noise Survey Results

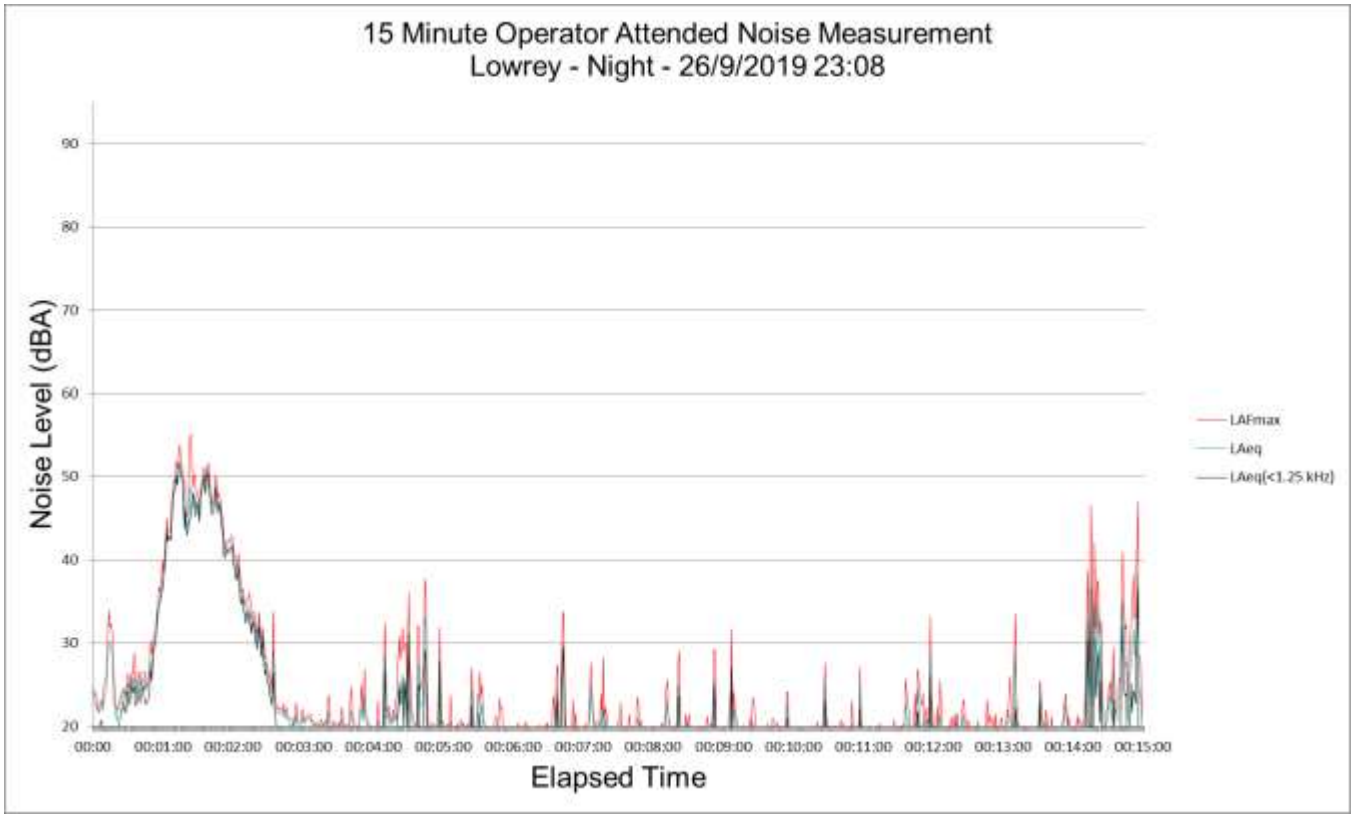


Figure B13 – Day Period – 'Pryce Jones' Operator Attended Noise Survey Results

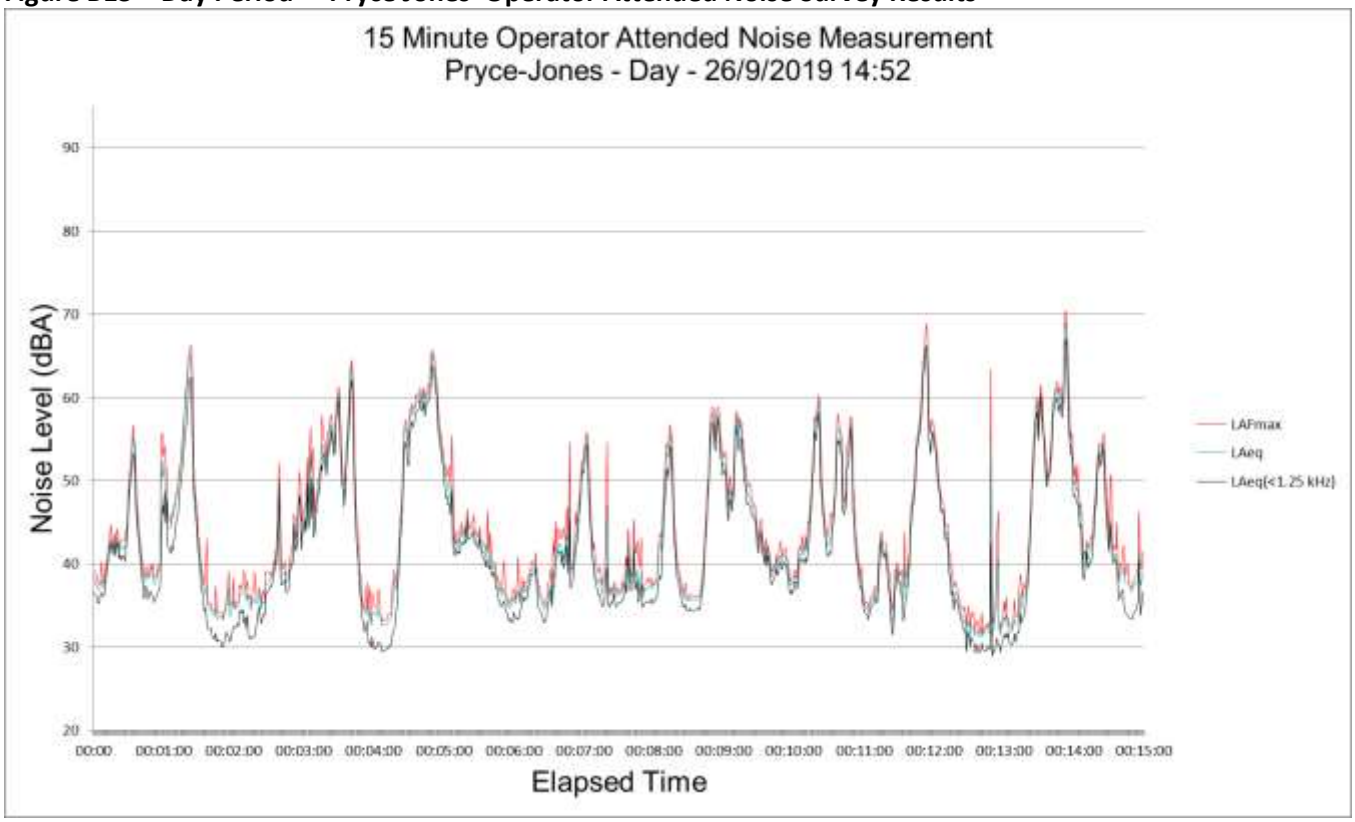


Figure B14 – Evening Period – 'Pryce Jones' Operator Attended Noise Survey Results

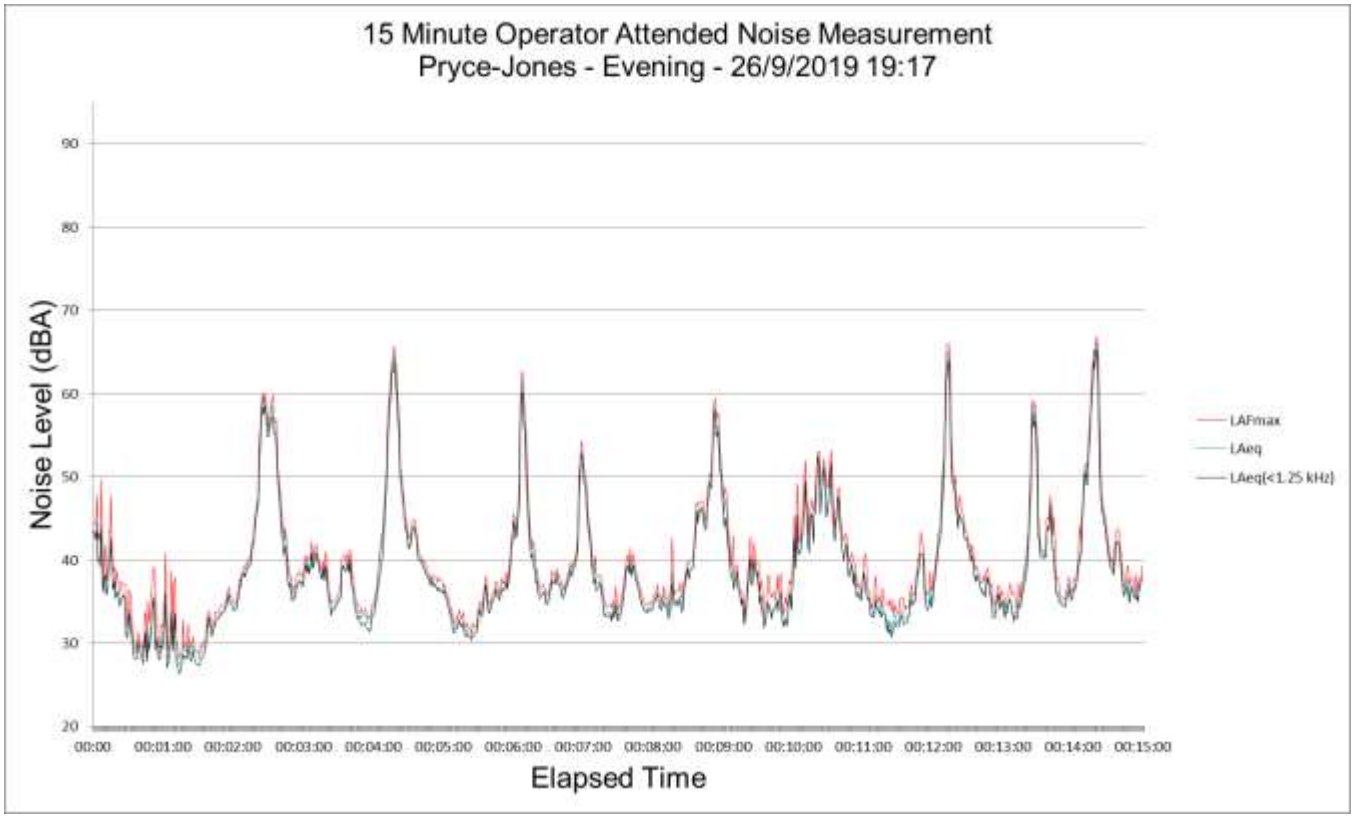


Figure B15 – Night Period – 'Pryce Jones' Operator Attended Noise Survey Results

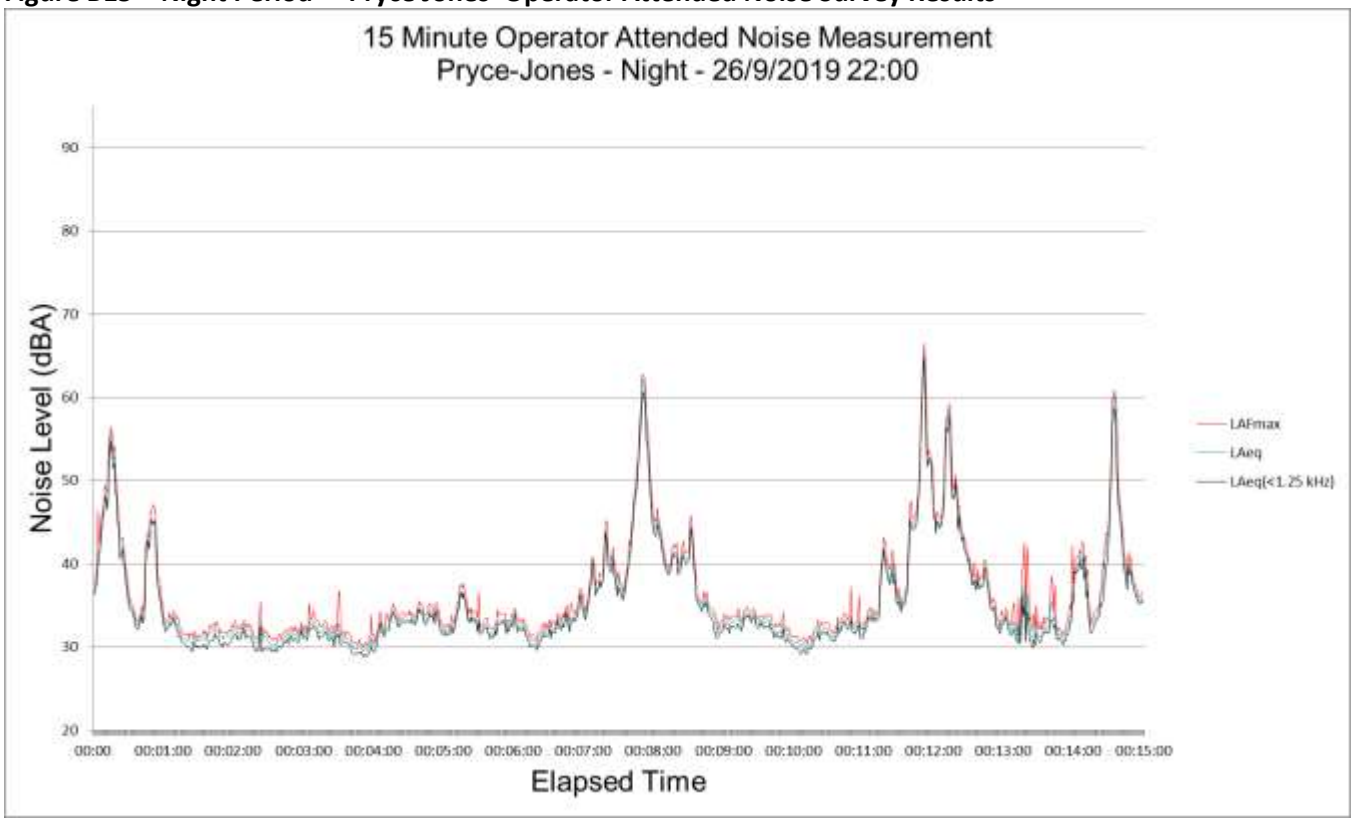


Figure B16 – Day Period – 'Van der Drift' Operator Attended Noise Survey Results

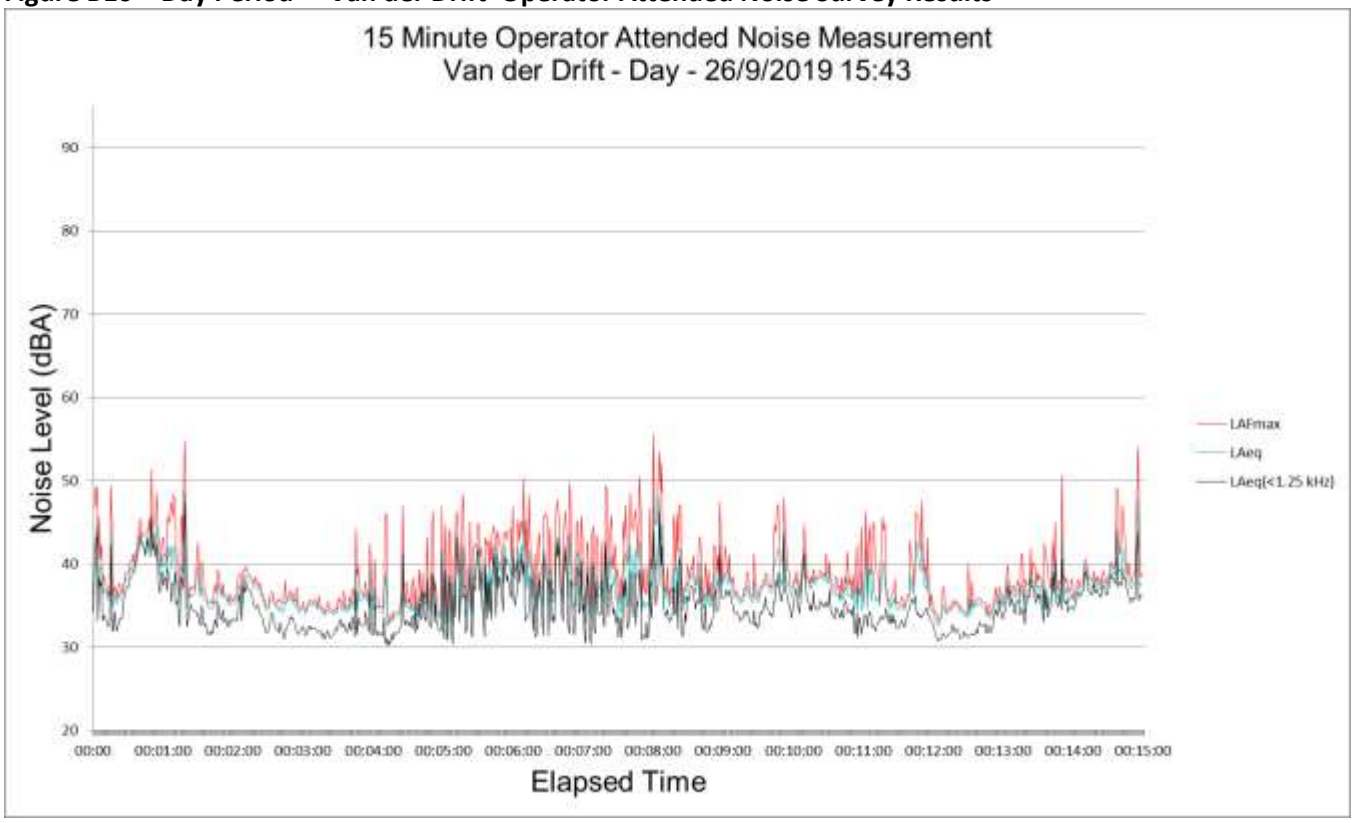


Figure B17 – Evening Period – 'Van der Drift' Operator Attended Noise Survey Results

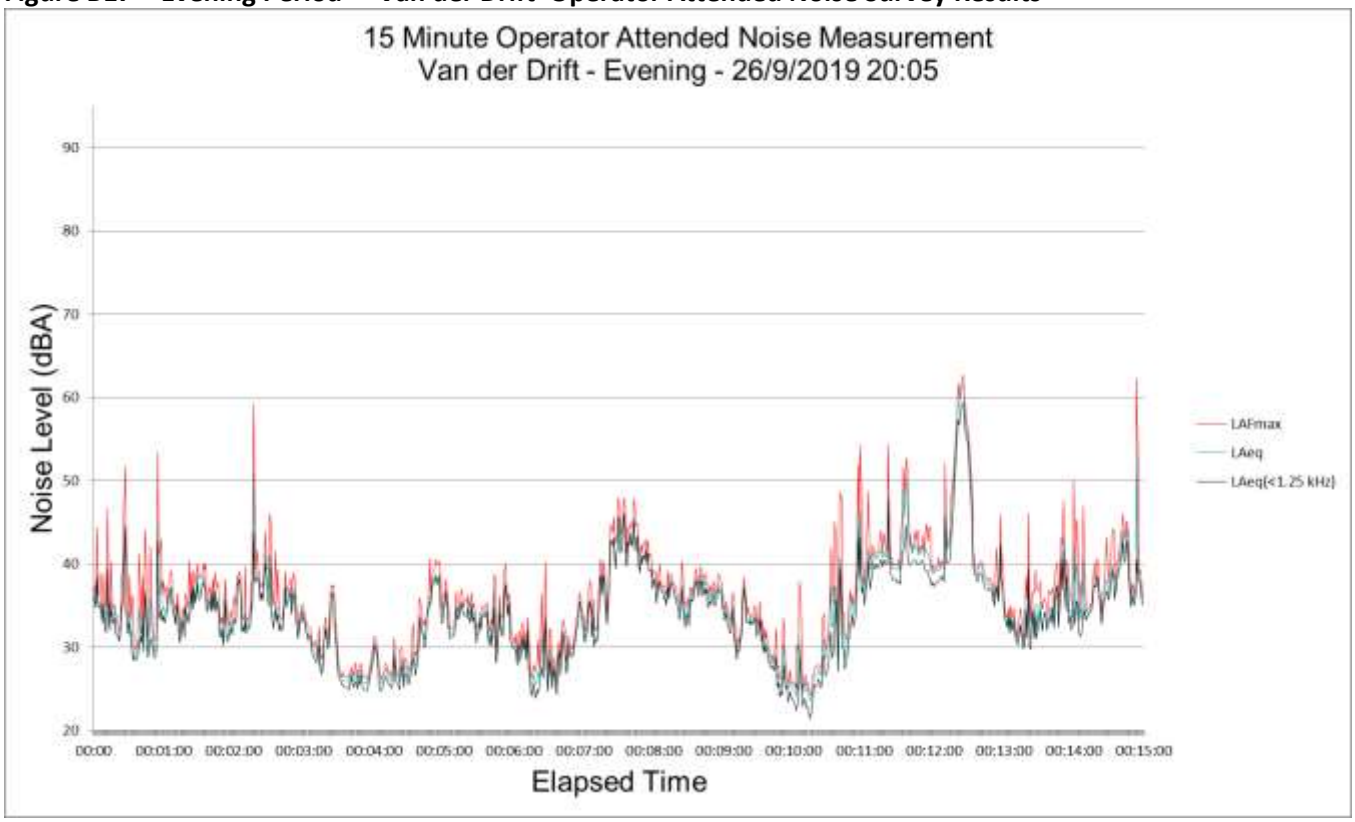


Figure B18 – Night Period – 'Van der Drift' Operator Attended Noise Survey Results

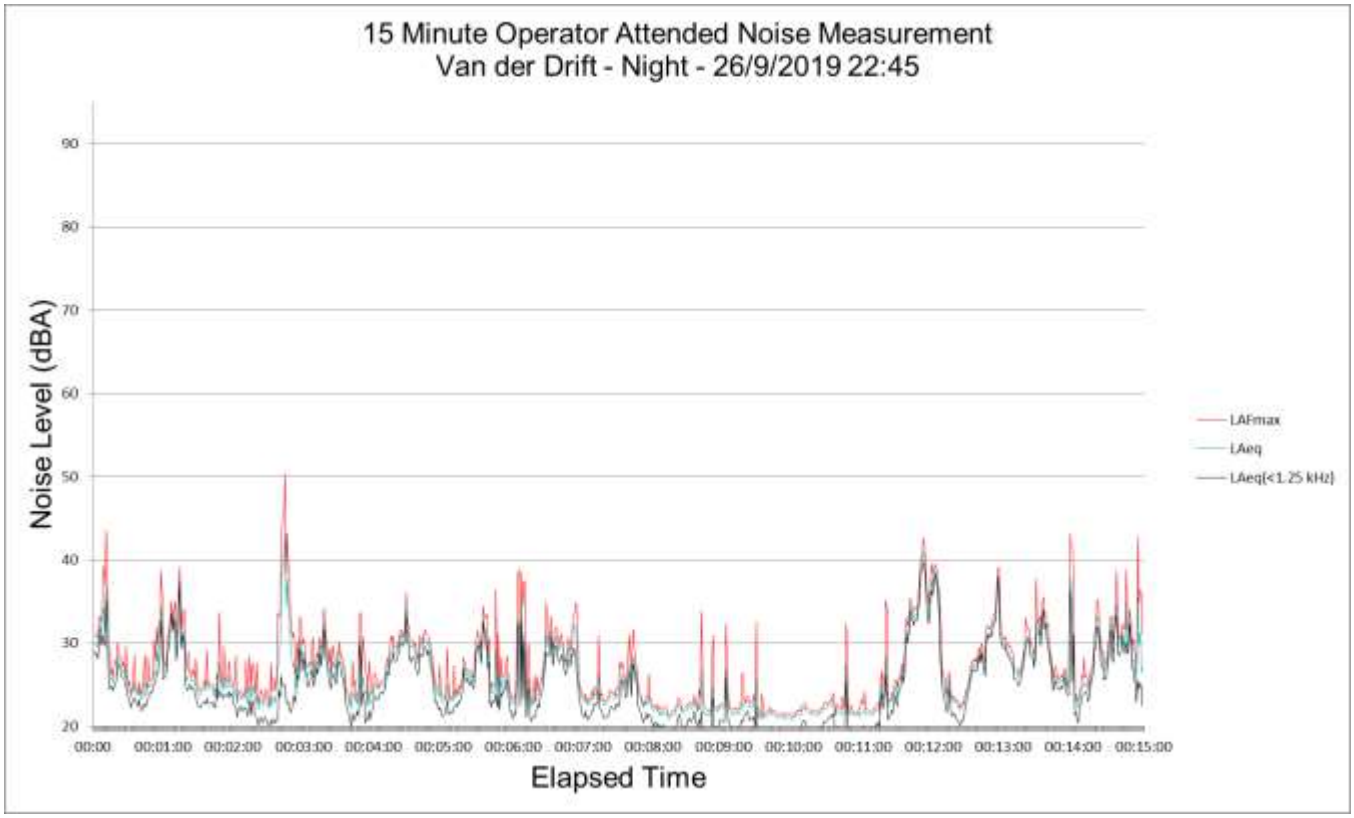


Figure B19 – Day Period – 'RTNM1' Operator Attended Noise Survey Results

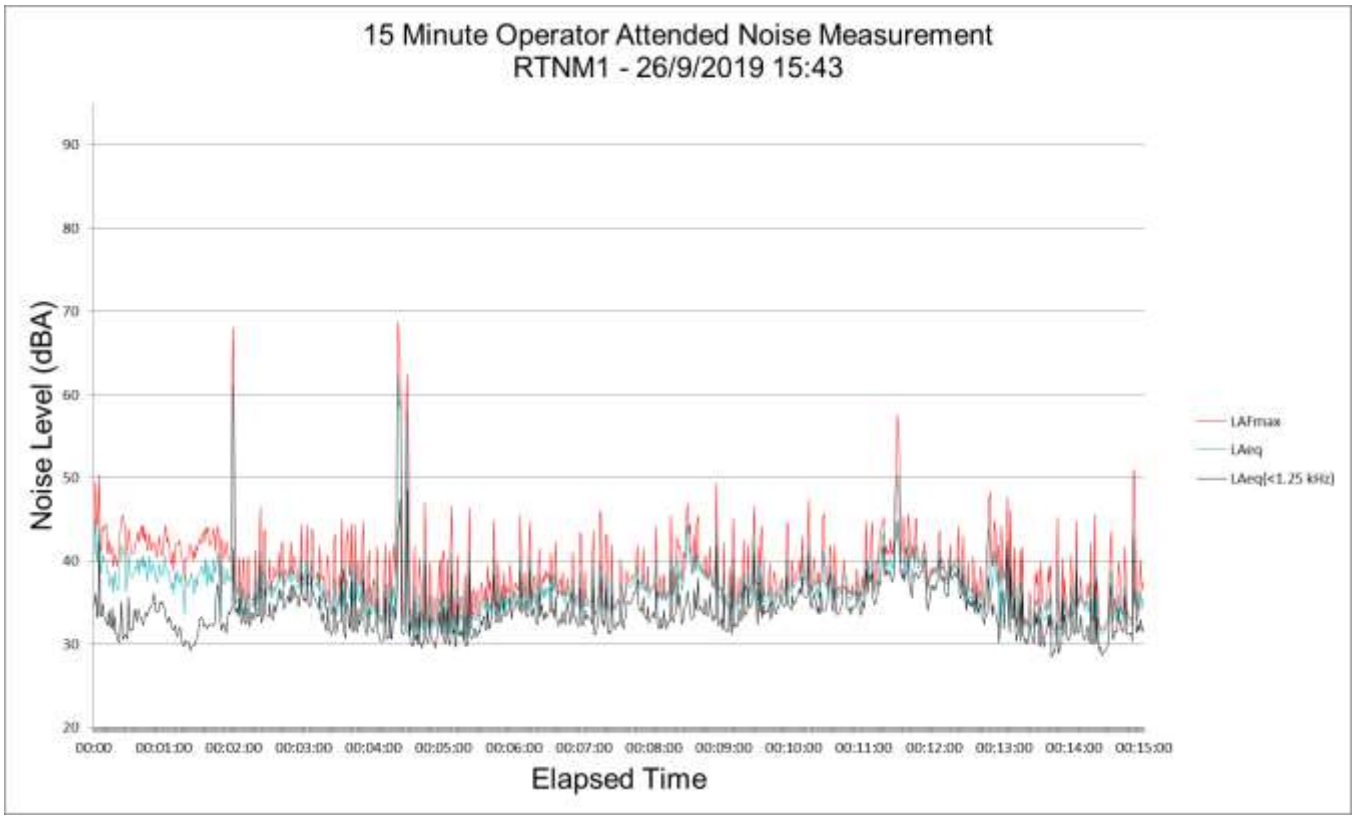
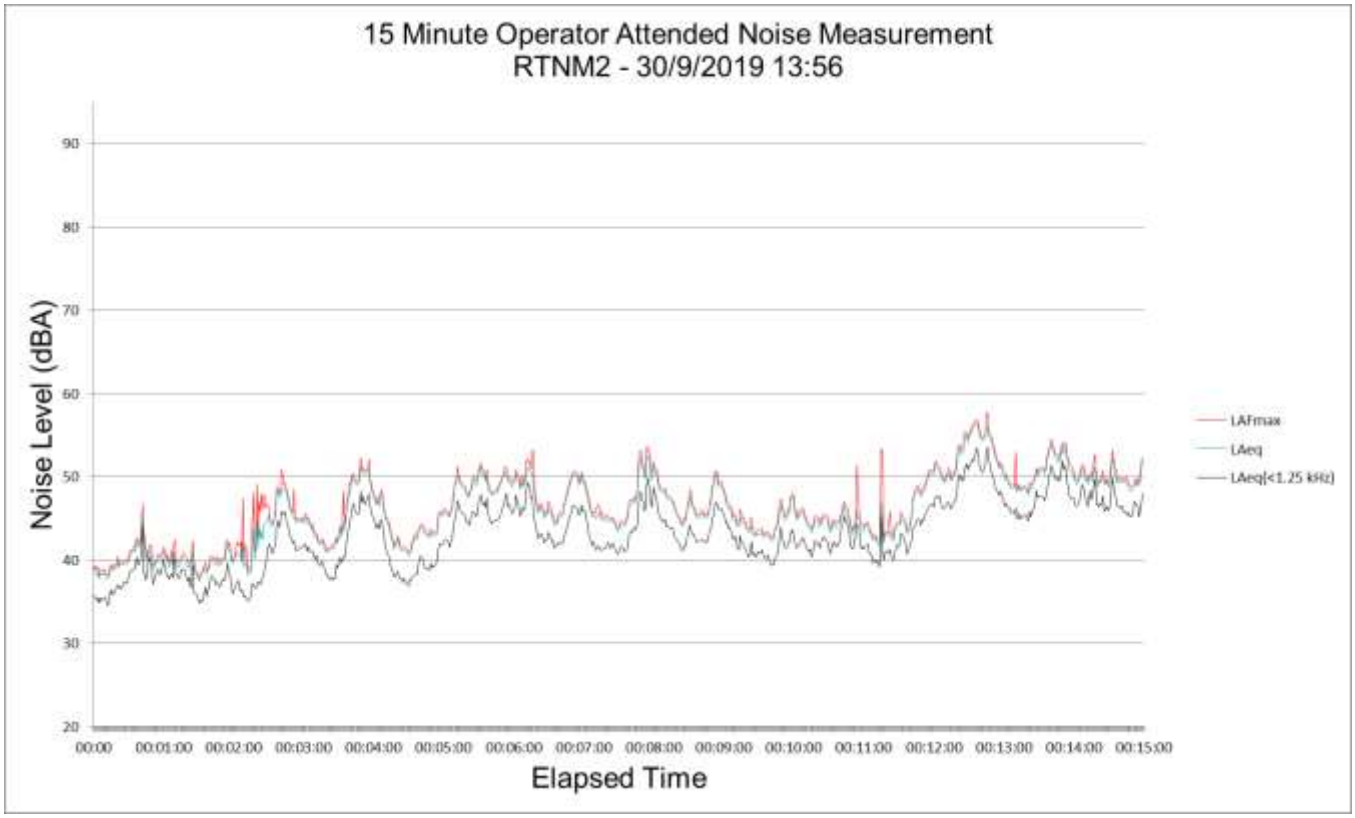


Figure B20 – Day Period – 'RTNM2' Operator Attended Noise Survey Results



ASIA PACIFIC OFFICES

BRISBANE
Level 2, 15 Astor Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

CANBERRA
GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

DARWIN
5 Foelsche Street
Darwin NT 0800
Australia
T: +61 8 8998 0100
F: +61 2 9427 8200

GOLD COAST
Level 2, 194 Varsity Parade
Varsity Lakes QLD 4227
Australia
M: +61 438 763 516

MACKAY
21 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

MELBOURNE
Suite 2, 2 Domville Avenue
Hawthorn VIC 3122
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

NEWCASTLE
10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

PERTH
Ground Floor, 503 Murray Street
Perth WA 6000
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

SYDNEY
2 Lincoln Street
Lane Cove NSW 2066
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

TOWNSVILLE
Level 1, 514 Sturt Street
Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

TOWNSVILLE SOUTH
12 Cannan Street
Townsville South QLD 4810
Australia
T: +61 7 4772 6500

WOLLONGONG
Level 1, The Central Building
UoW Innovation Campus
North Wollongong NSW 2500
Australia
T: +61 404 939 922

AUCKLAND
68 Beach Road
Auckland 1010
New Zealand
T: +64 27 441 7849

NELSON
6/A Cambridge Street
Richmond, Nelson 7020
New Zealand
T: +64 274 898 628