AMERESCO

METRODOME LEISURE COMPLEX, BARNSLEY

NOISE ASSESSMENT FOR PLANNING PURPOSES

22 April 2020

AEC REPORT: P4054/R1B/MR

Acoustic & Engineering Consultants Limited
Lockside 1 Stockport Road Marple Stockport Cheshire SK6 6BD
Telephone 0161 449 5900 mail@aecltd.co.uk www.aecltd.co.uk

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DOCUMENT STATUS

Prepared by: M F Ridley BMus(Hons) AMIOA

Revision	Date	Document Details	Author	Checked By
-	19-02-2020	Original Document	MR	DMT
A	21-04-2020	Updated following LPA comments	DMT	PJK
B	22-04-2020	Updated to include Executive Summary	DMT	-

EXECUTIVE SUMMARY

AEC has surveyed baseline noise levels at nearby noise sensitive receptors and, based on source noise levels provided by the CHP supplier, the potential noise impact of the proposed CHP plant has been assessed. The assessment can be summarised as follows:

- The CHP supplier has confirmed a measured single figure noise level of 52dB(A) at 10 metres.
- There is an existing brick wall which surrounds the proposed CHP plant location, at least 1 to 3 metres above the ground height at the CHP plant location, providing an overall reduction of around -2dB. **This results in CHP noise levels would be around 50dB(A) at 10 metres.**
- A worst-case assumption of +3dB for character correction has been applied to give the rating noise levels.
- The predicted CHP plant rating noise levels, at the nearest residential receptors, are below the existing background noise levels. Based on a BS4142 assessment, this gives an indication that noise from this source would have a 'low impact' on the existing residential receptors.

1.0 INTRODUCTION

1.1 Acoustic & Engineering Consultants Limited (AEC) has been instructed by Ameresco to undertake a noise assessment in relation to the proposed installation of new Combined Heat and Power (CHP) plant at the Metrodome Leisure Complex, Barnsley.

1.2 This report details AEC's measured noise levels and provides an assessment of the potential impact of noise emitted from the CHP plant on the nearest residential properties. This report takes into account the relevant guidance relating to this type of noise source. This is an updated version of the report following initial comments from the Local Authority and additional technical information from the suppliers.

1.3 AEC understands that the CHP plant would operate for over 90% of the time, 24 hours a day, 7 days a week. The CHP would only stop for planned maintenance and when loading is so low that the CHP cannot modulate.

1.4 As it is expected that the most noise sensitive period of operations would be during the night-time (2300 to 0700h), this assessment is considered worst-case based on achieving a suitable night-time noise level limit only.

1.5 Acoustic terminology is discussed in brief in Appendix A.

2.0 BACKGROUND AND SITE DESCRIPTION

2.1 AEC understand that the CHP plant is to be installed at the ground floor level outside the current coal store on the south façade of the building, as identified on Figure 1.

2.2 Directly to the south and west of the location for the proposed CHP plant is the carpark for the Metrodome. The carpark is slightly raised from the location of the plant and partially screened by a solid masonry wall (approximately 1 to 3m above the ground height at the proposed CHP location).

2.3 The nearest noise sensitive properties to the proposed CHP plant are those on Carey Avenue, 85m to the west. There are also properties approximately 110m to the south on Belgrave Road.

2.4 Further to the west is the dual carriageway Harborough Hill Road (A61).

3.0 NOISE MEASUREMENTS

3.1 Unattended noise level surveys were undertaken by AEC on Thursday 23 January 2020 between 1100 and 1930h and between 1500h on Tuesday 4 February 2020, and 1130h on Wednesday 5 February 2020. The location of the unattended noise measurements is identified as Location L (positioned above the site boundary wall) and is identified on the attached Figure 1.

3.2 Attended noise level measurements were undertaken by AEC between approximately 2000 and 2100h on Tuesday 4 February 2020, and 0000h and 0130h on Wednesday 5 February 2020. Measurement locations were chosen to be representative of the nearest noise sensitive properties on Carey Avenue (Locations A and C) and Belgrave Road (Location B). Locations A, B and C are identified on the attached Figure 1.

3.3 Spot check measurements were also undertaken close to the existing plant and during a coal delivery.

3.4 All measurements were undertaken in general accordance with BS7445-1: 2003 '*Description & measurement of environmental noise. Guide to quantities and procedures*'.

3.5 A full measurement procedure is presented in Appendix B and the measured data is presented in Table B1, B2, B3 and Graphs B1 and B2.

3.6 A summary of the typical ambient and background noise levels measured during the night-time at Locations L, A, B and C are presented in Table 3.1, below.

Table 3.1 – Measured Noise Levels

Location	Noise Level, dB	
	$L_{Aeq,T}$	$L_{A90,T}$
L (Site boundary)	59	58
A (Carey Avenue)	41	40
B (Belgrave Road)	37	35
C (Carey Avenue)	45	44

3.7 The background noise climate at Location L was dominated by the existing plant at the Metrodome Complex. The background noise climate at Locations A, B and C was dominated by a combination of existing plant and road traffic on Harborough Hill Road.

3.8 The noise level measured during a coal delivery was 89dB$L_{Aeq,1min}$ at 4m. These deliveries occur once or twice a week and take place during daytime hours only.

4.0 BASIS OF ASSESSMENT

4.1 AEC understands that Barnsley Metropolitan Borough Council (BMBC) require that noise from plant is assessed using guidance presented in BS 4142:2014 *'Methods for rating and assessing industrial and commercial sound'* (BS4142).

4.2 BS 4142 was revised in 2019, however, the latest revision has not significantly changed the assessment methodology.

4.3 In summary, BS 4142 states that *"The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*"

4.4 A 'rating' noise level ($dBL_{Ar,Tr}$) is obtained by applying a character correction to the 'specific' noise level ($dB_{Aeq,T}$) of a noise source (e.g. plant noise). The correction is applied if the noise has a defined acoustic character such as being tonal, impulsive, distinctive or intermittent in nature.

4.5 The magnitude of the correction is dependent on the character of the noise source and its level of perceptibility at the receiver.

4.6 A correction of up to +6dB and +9dB can be applied if the noise source is tonal or impulsive. Where the specific sound has characteristics, which are neither tonal nor impulsive but are distinctive against the residual sound climate, a +3dB penalty can be applied. A +3dB penalty can also be applied if the specific sound is intermittent in nature.

4.7 Based on the above, it is proposed that the rating noise level from the CHP plant does not exceed 5dB below the existing background noise level at the nearest noise sensitive receptors. However, provided the rating noise levels do not exceed the existing background noise levels at the noise sensitive receptors, then this would likely be a '*low impact*' on the residents and may be acceptable to the Local Authority.

5.0 ASSESSMENT OF PROPOSED CHP PLANT

5.1 The noise sources from the proposed CHP plant are: the main engine located in an acoustically treated container (approx. 7m by 3m by 3m); the separate dump radiator and intercooler radiator (low speed fans located approx. 1.5m off the ground adjacent to the container), and the gas exhaust outlet flue (terminating approximately 10m above ground).

5.2 The CHP plant is to be supplied by 2G Energy Limited and the supplier has confirmed a measured single figure noise level of 52dB(A) at 10 metres, which includes noise from all sources (CHP container, radiators and exhaust gas with silencers).

5.3 As mentioned above, the CHP plant will operate continuously at the same duty for the majority of the time and will not be switching on and off regularly. For this reason, it is not considered to be an intermittent noise source. In terms of tonality, based on measured noise spectrum data from other CHP engines assessed by AEC, they are not considered tonal, although there is typically a low frequency prominence around 125Hz.

5.4 Although the CHP noise is relatively broadband and unlikely to stand out significantly against the residual distant road traffic noise, as a worst-case assumption, the CHP noise could be considered to have a distinctive acoustic character, on account of this low frequency prominence. Therefore, a +3dB character correction has been applied to give the rating noise levels.

5.5 There is an existing brick wall which surrounds the proposed CHP plant location. The brick wall varies in height, but it is at least 1 to 3 metres above the ground height at the CHP plant location. This will ensure the radiator fans are fully screened from the residential properties. The brick wall will also provide an amount of screening to the CHP container. However, the exhaust flue will not benefit from any screening.

5.6 As a single figure sound pressure level has been provided for the whole CHP plant (not individual items) it is not possible to determine the acoustic attenuation provided by the brick wall. However, it is considered conservative to assume that the brick wall will provide around -5dB acoustic attenuation to the radiator fans and CHP container. The exhaust stack outlet is approximately 10 metres in the air and hence will not benefit from any screening, however, there is a long primary and secondary silencer proposed to control noise emissions up the ≈7m long stack.

5.7 Assuming that the exhaust and the combination of both the CHP container and adjacent radiators, emit a similar level of noise (a reasonable assumption based on other projects), then it sensible to conclude that the brick wall will provide acoustic attenuation of around -2dB.

5.8 Based on the proposed limits discussed in paragraph 4.7 above, the free-field rating noise level limits to be achieved external to the nearest noise sensitive receptors, at night (2300-0700h), are presented in Table 5.1, below.

Table 5.1 – Free-Field Night-Time Rating Noise Levels Limits At Noise Sensitive Receptors

Location	Rating Noise Level Limits (5dB Below Background), $dBL_{Ar,Tr}$	Rating Noise Level Limits (Equal to Background), $dBL_{Ar,Tr}$
A (Carey Avenue)	35	40
B (Belgrave Road)	30	35

5.9 Taking into account all of the above discussion, distance attenuation, and the proposed limits, the night-time BS4142 assessments for the CHP plant are presented in Tables 5.2 and 5.3, below.

Table 5.2 – Night-time BS4142 Assessment @ Location A – Carey Avenue

Description	Noise Levels	Comments
Measured Background Sound Level	$40dBL_{A90,T}$	Measured around midnight
Calculated Specific Sound	$33BL_{Aeq,T}$	Specific noise level calculated based on supplier data, minus distance attenuation (20 x Log (85/10) = 19dB).
Barrier Attenuation	-2dB	Radiator fans and CHP container fully or partially screened by existing brick wall. No screening to exhaust.
Specific noise level external to the nearest houses	$31dBL_{Aeq,T}$	Specific noise level minus barrier attenuation.
Acoustic feature correction	+3dB	The noise could be distinct due to low frequency prominence (+3dB)
Rating Level	(31 + 3) = $34dBL_{Ar,Tr}$	

Description	Noise Levels	Comments
Excess of rating over background sound level	(34 - 40) = -6	Indication of low impact.
Uncertainty	The supplier noise level is a single figure sound pressure level at 10 metres, therefore, there is uncertainty in the frequency characteristics and apportionment of noise to the different noise sources and assumptions of screening effects. However, this is partially off-set by worst case assumptions regarding background noise levels (lowest levels used) and +3dB character correction which may not be required. As this is an existing leisure site and the calculated absolute specific noise level is low, there is considered to be low uncertainty in the assessment outcomes.	

Table 5.2 – Night-time BS4142 Assessment @ Location B – Belgrave Road

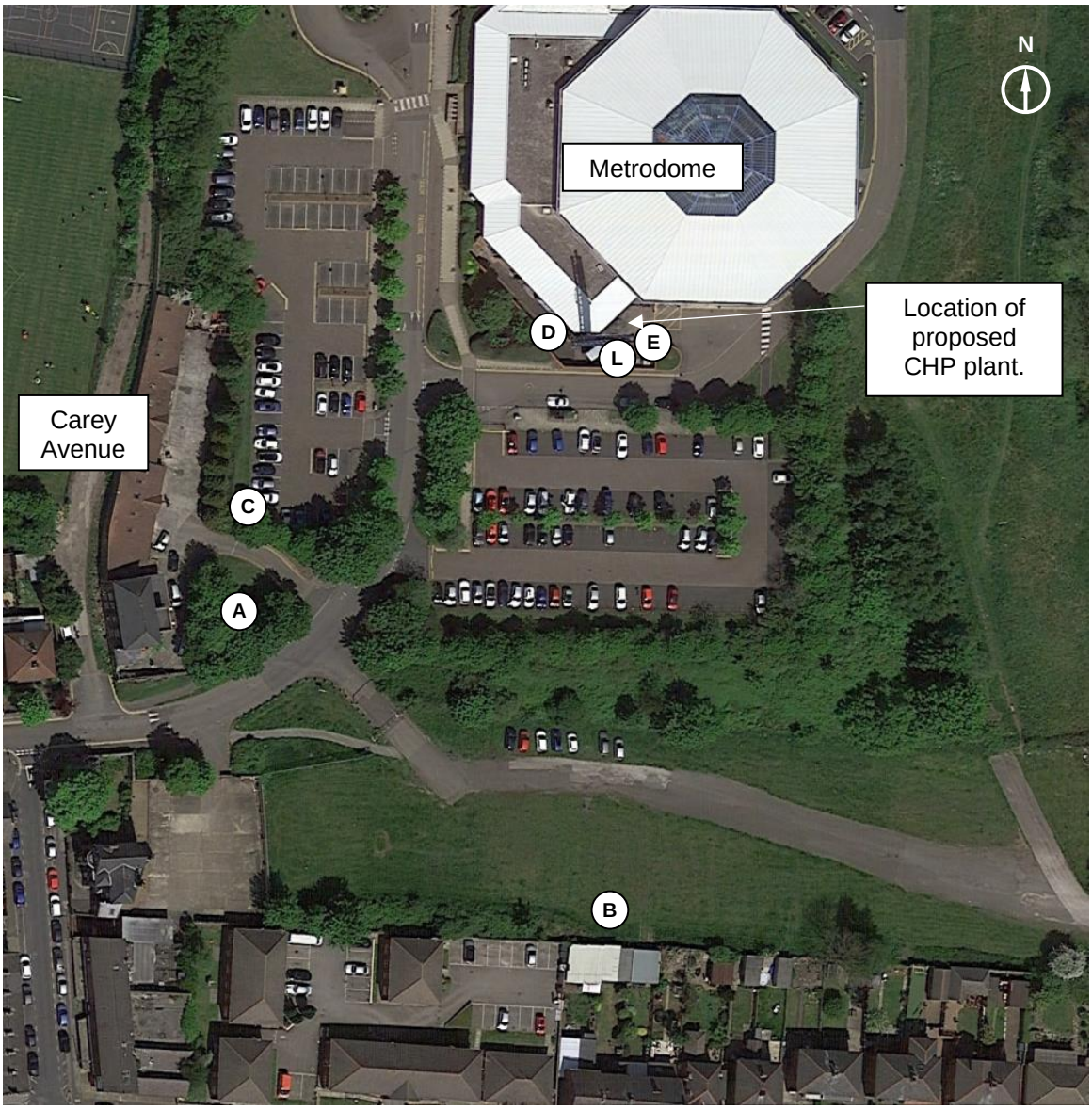
Description	Noise Levels	Comments
Background Sound Level	35dB$L_{A90,T}$	Measured around midnight
Specific Sound	31B$L_{Aeq,T}$	Specific noise level calculated based on supplier data, minus distance attenuation (20 x Log (110/10) = 21dB).
Barrier Attenuation	-2dB	Radiator fans and CHP container fully or partially screened by existing brick wall. No screening to exhaust.
Specific noise level external to the nearest houses	29dB$L_{Aeq,T}$	Specific noise level minus barrier attenuation.
Acoustic feature correction	+3dB	The noise could be distinct due to low frequency prominence (+3dB)
Rating Level	(29 + 3) = 32dB$L_{Ar,Tr}$	
Excess of rating over background sound level	(35 - 32) = -3	Indication of low impact. (rating noise level is low).
Uncertainty	The supplier noise level is a single figure sound pressure level at 10 metres, therefore there is uncertainty in the frequency characteristics and apportionment of noise to the different noise sources and assumptions of screening effects. However, this is partially off-set by worst case assumptions regarding background noise levels (lowest levels used) and +3dB character correction which may not be required. As this is an existing leisure site and the calculated absolute specific noise level is low, there is considered to be low uncertainty in the assessment outcomes.	

5.10 In summary, significant noise control measures will be installed to the CHP plant by the supplier, including, a sound insulated container, high performance (long) primary and secondary silencers to the exhaust and other supplier noise control treatments, such that noise from the unit is no greater than 52dB at 10m as stated by the supplier.

5.11 Based on this supplier information, assessment assumptions made by AEC and the findings of the baseline noise survey, a BS4142 assessment shows that during the worst-case night-time situation, the rating noise from the CHP would be below the existing background noise levels at all of the nearest receptors. BS4142 states that by controlling the rating noise level to below the existing background noise level it is an indication that noise from this source would have a low impact.

5.12 Therefore, in relation to any planning permission being sought and based on this assessment, noise should not be considered a determining factor.

FIGURE 1 – Existing Site Showing Monitoring Locations



Map data @2020 Google United Kingdom

APPENDIX A – Acoustic Terminology in Brief

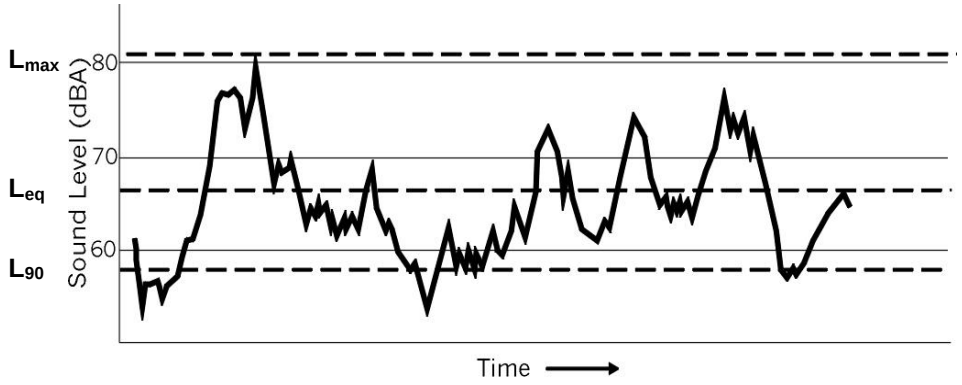
Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air. The rate at which the pressure fluctuations occur determines the pitch or *frequency* of the sound. The frequency is expressed in Hertz *(Hz)*, that is, cycles per second. The human ear is sensitive to sounds from about 20 Hertz to 20,000 Hertz. Although sound can be of one discreet frequency - a 'pure tone' - most sound is made up of many different frequencies.

The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same subjective way. This is the basis of the A-weighted sound pressure level *dBA,* normally used to assess the effect of noise on people. The dBA weighting emphasises or reduces the importance of certain frequencies within the audible range.

Sound Units

In order to assess environmental noise, measurements are carried out by sampling over specific periods of time, such as fifteen minutes or one hour, the statistically determined results being used to quantify various aspects of the sound.

The figure below shows an example of sound level varying with time. Because of this time variation the same period of sound can be described by several different levels. The most common of these are described below. It should be noted that in many instances in the main body of text, the unit will be proceeded by a dB descriptor in the report e.g. $L_{Aeq,T}$ could be written $dBL_{Aeq,\ T}$



Example of Sound Level Varying With Time

$L_{Aeq,T}$ The equivalent continuous (A-weighted) sound level. It may be thought of as the "average" sound level over a given time, T. It is used for assessing noise from various sources: industrial and commercial premises, construction sites, railways and other intermittent noises and can be considered as the "ambient" noise level.

$L_{A1,T}$ The (A-weighted) sound level exceeded for 1% of a measurement period. It is the value generally used to indicate a 'typical' maximum noise level.

$L_{A10,T}$ The (A-weighted) sound level exceeded for 10% of a measurement period. It is the value often used to describe traffic noise.

$L_{A90,T}$	The (A-weighted) sound level exceeded for 90% of a measurement period. It is the value often used to describe background noise.
L_{Amax}	The maximum (A-weighted) sound level measured during a given time. 'Fast' or 'Slow' meter response should be cited.
L_{AE}	The sound exposure level is a notional noise level and describes the average L_{Aeq} noise level of an event over a given time period as if it occurred during a one second period. This allows the L_{Aeq} to be determined over a time period with a number of distinct events.
Free-field Level	This refers to the sound level measured outside, away from reflecting surfaces.
Façade Level	This refers to the sound level measured outside, at 1m from a hard reflecting surface, typically 3dB greater than the free-field level.

APPENDIX B – Noise Survey Details

<table>
<tr><td>Date & Time of Survey:</td><td colspan="6">Unattended: Thursday 23 January 2020, 1100 to 1930h, Tuesday 4 February 2020, 1500h to Wednesday 5 February 2020, 1130h.</td></tr>
<tr><td></td><td colspan="6">Attended: Tuesday 4 February 2020, 2000 to 2100h and Wednesday 5 February 0000 to 0130h.</td></tr>
<tr><td>Personnel:</td><td colspan="6">Michael Ridley (AEC).</td></tr>
<tr><td>Equipment Used:</td><td colspan="6">Unattended: Cirrus CR:171B Real Time Analyser (AEC Kit 5).</td></tr>
<tr><td></td><td colspan="6">Attended: Cirrus CR:171B Real Time Analyser (AEC Kit 3).</td></tr>
<tr><td>Calibration:</td><td colspan="6">The sound level analysers, which conforms to BS EN 61672-1: 2003 ‘Electro acoustics – sound level meters - Part 1 Specifications’ for Class 1 Type Z meters, was in calibration and check calibrated before and after the measurement periods using a Brüel & Kjær type 4231 (94dB) calibrator. There was no significant drift of calibration. Calibration certificates are available on request.</td></tr>
<tr><td>Weather Conditions:</td><td colspan="6">Unattended:</td></tr>
<tr><td></td><td>Date</td><td>Period</td><td>Wet/Dry</td><td>Temp°C</td><td>Wind Speed & Direction</td><td>Cloud Cover</td></tr>
<tr><td></td><td>23 Jan 2020</td><td>Day</td><td>Dry</td><td>5°C</td><td>Southerly and 4m/s</td><td>30%</td></tr>
<tr><td></td><td>4 Feb 2020</td><td>Day</td><td>Dry</td><td>1°C</td><td>Westerly and 2m/s</td><td>50%</td></tr>
<tr><td></td><td>4/5 Feb 2020</td><td>Night</td><td>Dry</td><td>0°C</td><td>Westerly and 1m/s</td><td>20%</td></tr>
<tr><td></td><td>5 Feb 2020</td><td>Day</td><td>Dry</td><td>4°C</td><td>Southerly 4m/s</td><td>50%</td></tr>
<tr><td></td><td colspan="6">Attended:</td></tr>
<tr><td></td><td>Date</td><td>Period</td><td>Wet/Dry</td><td>Temp°C</td><td>Wind Speed & Direction</td><td>Cloud Cover</td></tr>
<tr><td></td><td>4 Feb 2020</td><td>Day</td><td>Dry</td><td>1°C</td><td>Westerly and 2m/s</td><td>50%</td></tr>
<tr><td></td><td>5 Feb 2020</td><td>Night</td><td>Dry</td><td>0°C</td><td>Westerly and 1m/s</td><td>20%</td></tr>
<tr><td>Measurement Locations:</td><td colspan="6">Unattended: The microphone was connected via an extension cable and fixed externally at a location 3m from the Metrodome, at first floor level, identified as L on Figure 1.</td></tr>
<tr><td></td><td colspan="6">Attended: Measurements were undertaken at 5 locations around the development site. Identified as A to D on Figure 1 and described below.

A – 85m from the Metrodome plant
B – 110m from the Metrodome plant
C – 70m from the Metrodome plant
D – 2m from the Metrodome plant
E – 4m from coal delivery</td></tr>
</table>

Measurement Details:	***Unattended:*** Measurements were logged continuously over 1s for post processing and assessment. This location was selected to represent the worst-case affected façade of the development that would be affected by mechanical plant noise.
	Attended*:* Measurements were undertaken over various periods in terms of L_{eq}, L_{10}, $L_{90,}$ and L_{max}.
Façade / Free-Field:	***Unattended:*** Free-Field
	Attended: A, B & C - free-field. D – façade
	Full results for the attended measurements are given in Tables B1 B2 and B3. The measured daytime and night-time periods for the unattended survey is presented on Graph B1 and B2.
Measured Data:	Full 1/3rd octave band centre frequency data was obtained for all measurements.

TABLE B1 – Measured Daytime Noise Levels (4 February 2020)

Location	Period, h	Noise Level, dB			Comments
		L_{Aeq}	L_{A90}	$L_{Amax, F}$	
A	2006 – 2014	45.7	44.3	54.6	Road Traffic and plant noise dominating (all localised traffic in the car park paused out of measurement).
	2015 – 2030	52.2	44.6	69.4	Road Traffic in the car park dominating and distant road traffic and plant noise in the background.
B	2032 – 2038	46.6	42.9	64.0	Road Traffic in the car park dominating and distant road traffic and plant noise in the background.
	2037 – 2041	44.3	43.1	51.0	Road Traffic and plant noise dominating (all localised traffic in the car park paused out of measurement).
D	2002 – 2003	72.1	71.8	73.0	Plant measurement.

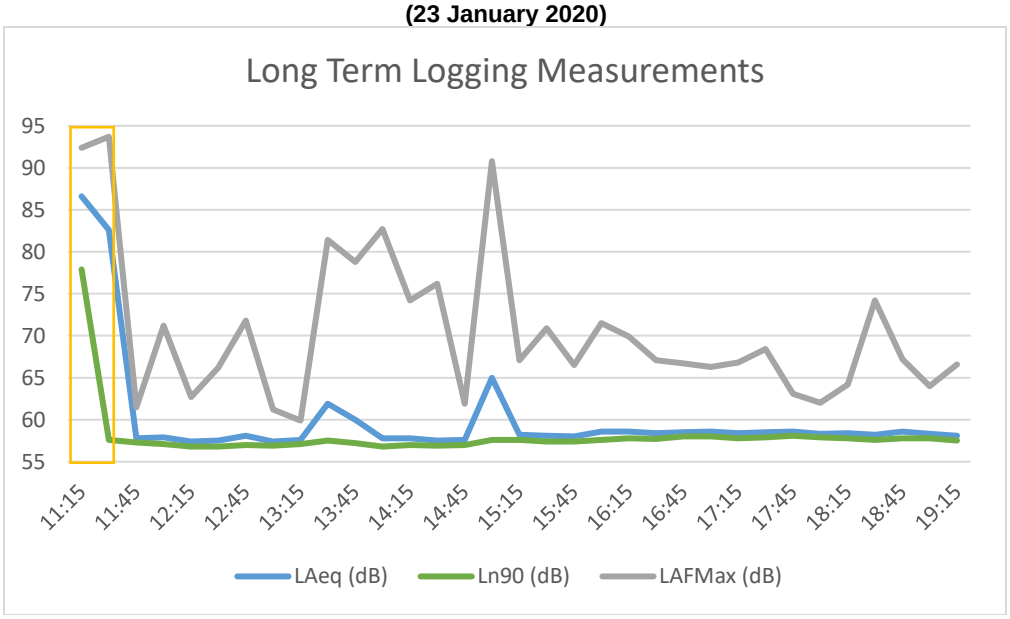
TABLE B2 – Measured Evening and Night-Time Noise Levels

Location	Period, h	Noise Level, dB			Comments
		L_{Aeq}	L_{A90}	$L_{Amax, F}$	
A	0006 – 0016	41.0	40.1	50.5	Noise dominated by plant and distant road traffic.
	0052 – 0057	41.0	40.2	50.0	
	0111 – 0116	41.6	40.7	56.7	
B	0018 – 0028	37.9	36.4	49.4	Noise dominated by plant and distant road traffic.
	0058 – 0103	39.6	37.5	47.4	
	0118 – 0123	36.8	35.4	51.4	
C	0031 – 0038	44.9	44.3	52.1	Noise dominated by plant and distant road traffic.
	0105 – 0110	45.8	45.2	51.2	

TABLE B3 – Measured Daytime Noise Levels (23 January 2020)

Location	Period, h	Noise Level, dB			Comments
		L_{Aeq}	L_{A90}	$L_{Amax, F}$	
E	1104 – 1105	89.0	88.1	91.7	Dominated by Coal Delivery

GRAPH B1 – Long-Term Logging Measurements
(23 January 2020)



Coal Delivery

GRAPH B2 – Long-Term Logging Measurements
(4 February 2020 – 5 February 2020)