The Co-operative

Boscombe Road
Amesbury
SP4 7JH

Plant Noise
Impact Assessment

On behalf of

Epta

Project Reference: 91857| Revision: 01 | Date: 5th March 2024
Revised: 18th March 2024

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Document Information

Project Name	:	**The Co-operative, Boscombe Down**
Project Reference	:	**91857**
Report Title	:	**Plant Noise Impact Assessment Report**
Doc Reference	:	**91857/NIA**
Date	:	**5th March 2024**

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For and on behalf of Noise Solutions Ltd				

Revision	Date	Description	Prepared	Reviewed/ Approved
01	18/03/2024	Update of mitigation strategy	ZJ	JS

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1.0 Introduction

1.1. Noise Solutions Ltd (NSL) has been commissioned by Epta to provide a noise impact assessment for replacement plant serving the Co-operative store located along Boscombe Road in Amesbury.

1.2. An environmental sound survey has been undertaken to establish the prevailing background sound pressure levels at a location representative of the sound levels outside the nearest noise sensitive receptors to the site.

1.3. Plant noise levels have been predicted at the nearest noise-sensitive premises and assessed against the local authority's usual requirements.

1.4. To assist with the understanding of this report a glossary of acoustic terms can be found in **Appendix A**. An in-depth glossary of acoustic terms can be viewed online at www.acoustic-glossary.co.uk.

2.0 Details of development proposals

2.1. The store occupies a dedicated one-storey building located on Boscombe Road, Amesbury.

2.2. It is understood that the proposed plant will be located in an external plant area to the south of the store, replacing the existing plant.

2.3. The proposed refrigeration plant will potentially operate 24 hours a day, although it should be noted that these units operate as required to meet demand and generally at a reduced capacity at night.

3.0 Nearest noise sensitive receptors

3.1. The nearest residential properties to the Co-operative store are located as follows:

- Receiver 1 (R1) - House located to southeast, approximately 13m away from the nearest plant item.
- Receiver 2 (R2) - House located to the southwest, approximately 33m away from the nearest plant item.
- Receiver 3 (R3) - House located to the northeast, approximately 23m away from the nearest plant item.

3.2. All other residential properties and commercial buildings are further from the plant area, with many also being screened by the building orientation.

3.3. A site plan showing the site and surrounding area, the nearest noise sensitive properties and noise monitoring location used in this assessment is presented in **Appendix B**.

4.0 Existing noise climate

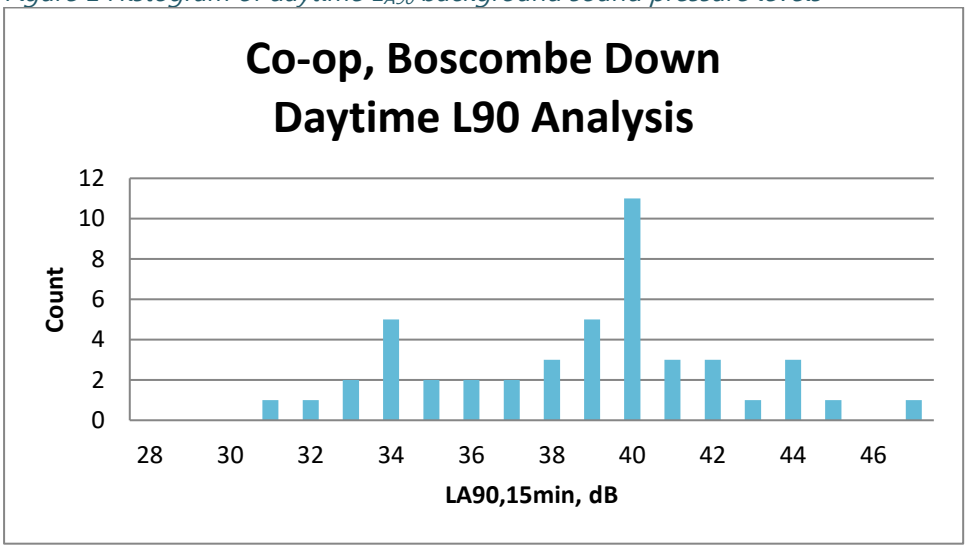
4.1. An environmental noise survey was undertaken to establish the typical background sound levels at a location representative of the noise climate outside the façades of the nearest noise sensitive receptors.

4.2. The results of the environmental sound survey are summarised in Table 1 below. The full set of measurement results and details of the survey methodology are presented in **Appendix C**.

Table 1 Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	$L_{Aeq(15mins)}$	$L_{Amax(15mins)}$	$L_{A10(15mins)}$	$L_{A90(15mins)}$
Daytime (07.00 – 23.00 hours)	35-58	47-83	37-58	31-47
Night-time (23.00 – 07.00 hours)	32-51	44-76	34-51	28-42

Figure 1 Histogram of daytime L_{A90} background sound pressure levels

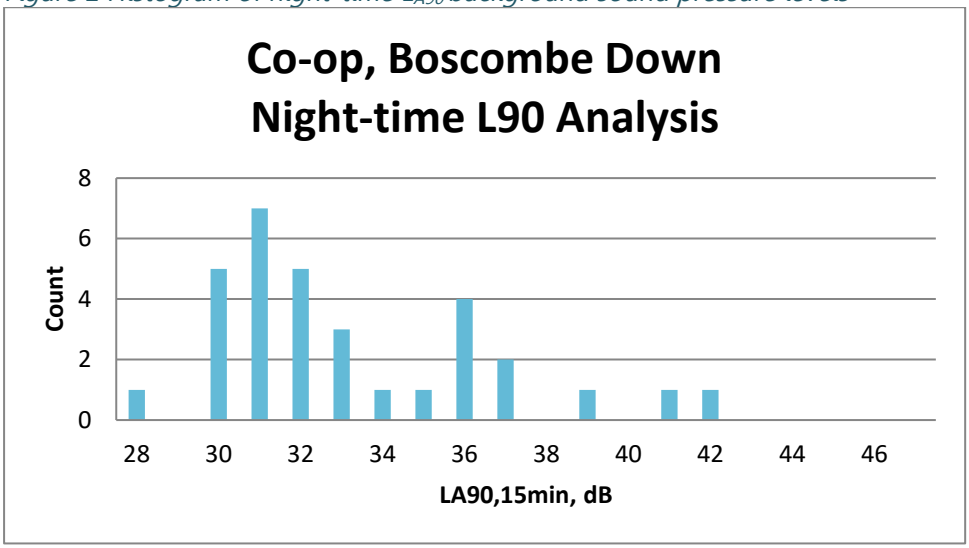


4.3. Additional statistical analysis has been undertaken. As shown in Table 2, the mean, median, and modal values have been calculated:

Table 2 Statistical analysis of $L_{A90,15min}$ levels during the daytime period

dB, L_{A90} daytime period	
Mean	39
Mode	40
Median	39

Figure 2 Histogram of night-time L_{A90} background sound pressure levels



4.4. Additional statistical analysis has been undertaken. As shown in Table 3, the mean, median, and modal values have been calculated:

Table 3 Statistical analysis of $L_{A90,15min}$ levels during the night-time period

dB, L_{A90} night-time period	
Mean	33
Mode	31
Median	32

4.5. Based on the histogram analyses above and the time history graph displayed in **Appendix C**, the following values have been considered as representative of the existing background sound pressure levels at nearby noise sensitive premises:

- 39dB L_{A90} during the daytime period; and
- 30dB L_{A90} during the night-time period.

4.6. The above values have been selected to be representative of periods when local road traffic was at a minimum and background sound levels are therefore due to more-distant noise sources also affecting the residential property closest to the plant area.

5.0 Plant noise design criteria

Wiltshire County Council

5.1. It is understood that Wiltshire County Council typically requires an assessment to be undertaken in accordance with BS 4142:2014, with the plant rating level being at least 5dB below the background level.

BS4142:2014 Methods for Rating and Measuring Industrial and Commercial Sound'

5.2. British Standard (BS) 4142:2014 describes a method for rating and assessing sound of an industrial or commercial nature, which includes sound from fixed installations which comprise mechanical and electrical plant and equipment.

5.3. The industrial or commercial sound is assessed outside a dwelling or premises used for residential purposes, upon which sound is incident.

5.4. The procedure contained in BS 4142 is to quantify the "specific sound level", which is the measured or predicted level of sound from the source in question over a one-hour period for the daytime and a 15-minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.

5.5. The specific sound level is converted to a rating level by adding penalties on a sliding scale to account for either potentially tonal or impulsive elements. The standard sets out objective methods for determining the presence of tones or impulsive elements but notes that it is acceptable to subjectively determine these effects.

5.6. The penalty for tonal elements is between 0dB and 6dB, and the standard notes: *"Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible."*

5.7. The penalty for impulsive elements is between 0dB and 9dB, and the standard notes: *"Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."*

5.8. The background sound level should be established in terms of the L_{A90} noise index. The standard states that the background sound level should be measured over a period of sufficient length to obtain a representative value. This should not normally be less than 15-minute intervals. The standard states that: *"A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."*

5.9. The assessment outcome results from a comparison of the rating level with the background sound level. The standard states:

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) 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.

Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."

5.10. The standard goes on to note that: "*Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."*

5.11. In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014 edition places emphasis upon an appreciation of the context, as follows:

"An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context."

5.12. BS 4142 requires uncertainties in the assessment to be considered, and where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

Low background sound levels

5.13. As described in BS 4142:2014, where background noise levels are low it is appropriate to consider the absolute noise level. From guidance published by the World Health Organization[1] when windows are partially open for ventilation internal noise levels within dwellings are typically 15dBA lower than the noise level at the façade. Therefore, a plant noise level of 30dBA at the nearest residential window would result in internal noise levels of around 15-20dBA when

[1] World Health Organization Regional Office for Europe, *Environmental Noise Guidelines for the European Region*, 2018

windows are open, a level lower than that resulting from domestic refrigerators etc. within the dwellings.

Proposed criteria

5.14. Based on the above background data, noise at the nearest noise-sensitive receptor, must not exceed the limits in Table 3 below.

Table 3 Plant noise emissions limits at sensitive receptors

Period	Cumulative plant noise rating level, dB(A)
Daytime (07.00 – 23.00 hours)	34
Night-time (23.00 – 07.00 hours)	30

5.15. The above limits have not been approved by the local authority at this stage.

6.0 Plant noise impact assessment

6.1. The cumulative plant noise levels at the nearest noise sensitive receptors have been predicted. The assessment has considered directivity, distance and screening between the sources and receivers.

6.2. The predictions have been based on the replacement AC and refrigeration plant operating at full capacity during the daytime. Only the refrigeration units have been considered during the night-time period.

6.3. It should be noted that the proposed plant is not anticipated to exhibit any tonal or impulsive characteristics provided it is well maintained. All proposed plant will be inverter driven and, therefore, will gently ramp up and down depending on the demands on the various systems. The plant is also not expected to contain any significant low frequency tones, as stated in BS 4142:2014:2014. However, a penalty of 3dB as described in BS 4142:2014 has been applied for the possible presence of "*...characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment...*".

6.4. Table 4 summarises the results of the assessment at the nearest noise sensitive receptors. All other nearby receptors benefit from increased distance/screening to the plant such that resulting noise levels will be lower than at the receptors considered. The full set of calculations can be found in **Appendix F**.

Table 4 Assessment of predicted noise levels at the nearest noise sensitive receptors

Receptor	Period	Predicted noise rating level at receptor, L_{Aeq} (dB)	Criterion (dB)	Difference
R1	Daytime (07.00 - 23.00 hours)	33	34	-1
	Night-time (23.00 - 07.00 hours)	28	30	-2
R2	Daytime (07.00 - 23.00 hours)	32	34	-2
	Night-time (23.00 - 07.00 hours)	28	30	-2
R3	Daytime (07.00 - 23.00 hours)	25	34	-9
	Night-time (23.00 - 07.00 hours)	21	30	-9

6.5. The noise level predictions demonstrate that cumulative noise emissions from the replacement plant will comply with the proposed limits at the nearest noise sensitive properties, inclusive of a timber barrier a minimum of 1.6m in height on the eastern boundary of the plant area.

Context and uncertainties

6.6. As BS 4142:2014 advises, the impact must be considered within the context of the site and the surrounding acoustic environment. The following must, therefore, also be taken into consideration when determining the potential impact that may be experienced:

- The assessment is undertaken at the nearest residential windows. The impact on all other nearby residential windows will be lower due to screening and distance attenuation.
- The noise level predictions are based on the proposed equipment running at maximum daytime duty. The plant will not run in this manner at all times (for example, when demands for heating/cooling are lower) and, therefore, this is a robust assessment.
- The proposed plant is replacing existing equipment in the same location.

6.7. Where possible uncertainty in the above assessments has been minimised by taking the following steps:

- The meter and calibrator used have a traceable laboratory calibration and the meter was field calibrated before and after the measurements.

- Uncertainty in the calculated impacts has been reduced by the use of a well-established calculation method.

7.0 Summary

7.1. Noise Solutions Ltd (NSL) has been commissioned by Epta to provide a noise impact assessment for replacement plant serving the Co-operative store located along Boscombe Road in Amesbury.

7.2. An environmental sound survey has been undertaken to establish the prevailing background sound pressure levels at a location representative of the sound levels outside the nearest noise sensitive receptor to the site.

7.3. Cumulative plant noise emission levels for the replacement plant have been predicted at the most affected noise sensitive receptors and assessed against the local authority's usual requirements.

7.4. The noise level predictions demonstrate that cumulative noise emissions from the replacement plant will comply with the proposed limits at the nearest noise sensitive properties, when inclusive of a timber barrier with a minimum of 1.6m in height on the eastern boundary of the plant area. Noise from fixed plant should not be grounds for refusal of planning permission.

Appendix A Acoustic terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 $\log_{10}$ (s1/s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A –weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$	A noise level index. The noise level that is exceeded for 90% of the measurement time interval, T. It gives an indication of the lower levels of fluctuating noise. It is often used to describe the background noise level and can be considered to be the "average minimum" noise level and is a term used to describe the level to which non-specific noise falls during quiet spells, when there is lull in passing traffic for example.

Appendix B Aerial photograph site showing areas of interest



Appendix C Environmental sound survey

Details of sound surveys

C.1 Measurements of the existing background sound levels were undertaken between 15.45 hours on Monday 2nd October and 11.15 hours on Tuesday 3rd October 2023.

C.2 The sound level meter was programmed to record the A-weighted L_{eq}, L_{90}, L_{10} and L_{max} noise indices for consecutive 15-minute sample periods for the duration of the noise survey.

Measurement position

C.3 The sound level meter was positioned on a lamppost at Harward Way. The approximate location of the microphone is indicated on the aerial photograph in **Appendix B**. In accordance with BS 7445-2:1991 *'Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use'*, the measurements were undertaken under free-field conditions.

C.4 In accordance with BS 7445-2:1991 'Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use', the measurements were undertaken under free-field conditions.

Equipment

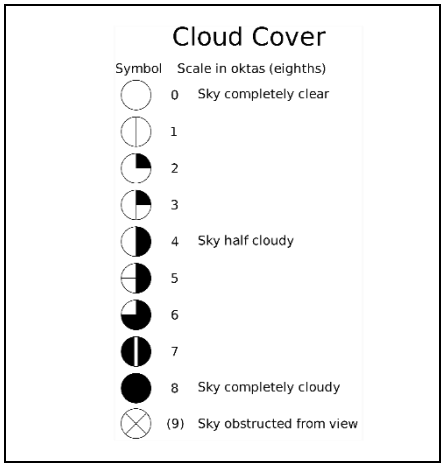
C.5 Details of the equipment used during the survey are provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (+/-0.2 dB) in the calibration level was noted.

Environmental noise survey

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 971A / 124660	01/06/2023	1505421-1
Condenser microphone	ACO Pacific 7052E / 81197		
Preamplifier	Svantek SV18A / 130661		
Calibrator	Svantek SV33B / 125546	02/06/2023	1505532-1

Weather conditions

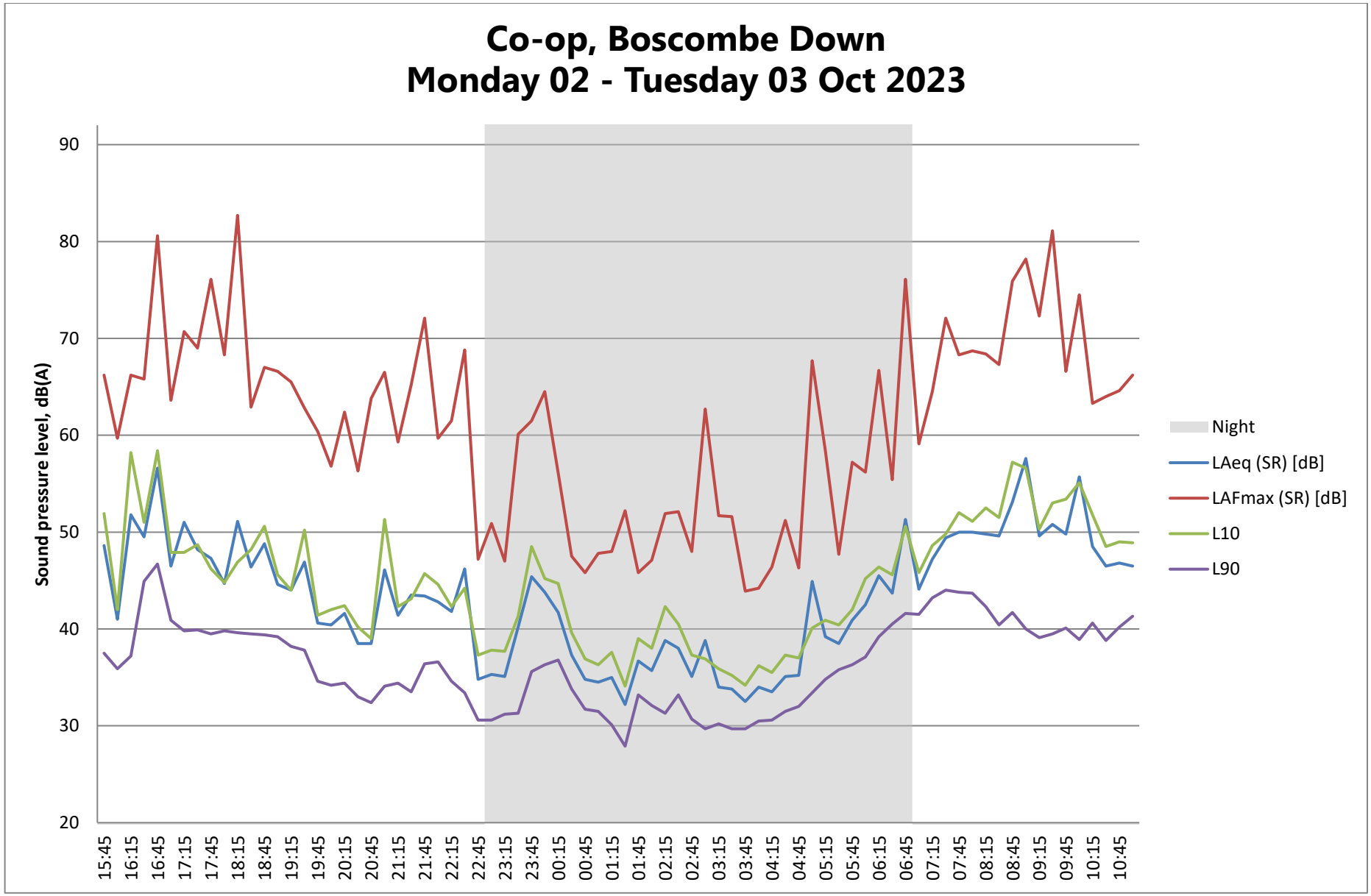
C.6 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were generally appropriate for environmental noise measurements. The table below presents the weather conditions recorded on site at the beginning and end of the survey.

Weather Conditions				
Measurement Location	**Date/Time**	**Description**	**Beginning of Survey**	**End of Survey**
As indicated on Appendix B	15.45 02/10/23 – 11.15 03/10/23	Temperature (°C)	16	15
		Precipitation:	None	None
		Cloud cover (oktas – see guide)	8	2
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	Yes	Wet
		Wind Speed (m/s)	2	3
		Wind Direction (from)	E	S/W
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

Results

C.7 The results of the survey are considered to be representative of the background sound pressure levels at the façades of the most affected noise sensitive receptors. The noise climate at the measurement position was dominated by local road traffic.

C.8 The results of the survey are presented in a time history graph overleaf.


Co-op, Boscombe Down
Monday 02 - Tuesday 03 Oct 2023
Sound pressure level, dB(A)
90
80
70
60
50
40
30
20
15:45
16:15
16:45
17:15
17:45
18:15
18:45
19:15
19:45
20:15
20:45
21:15
21:45
22:15
22:45
23:15
23:45
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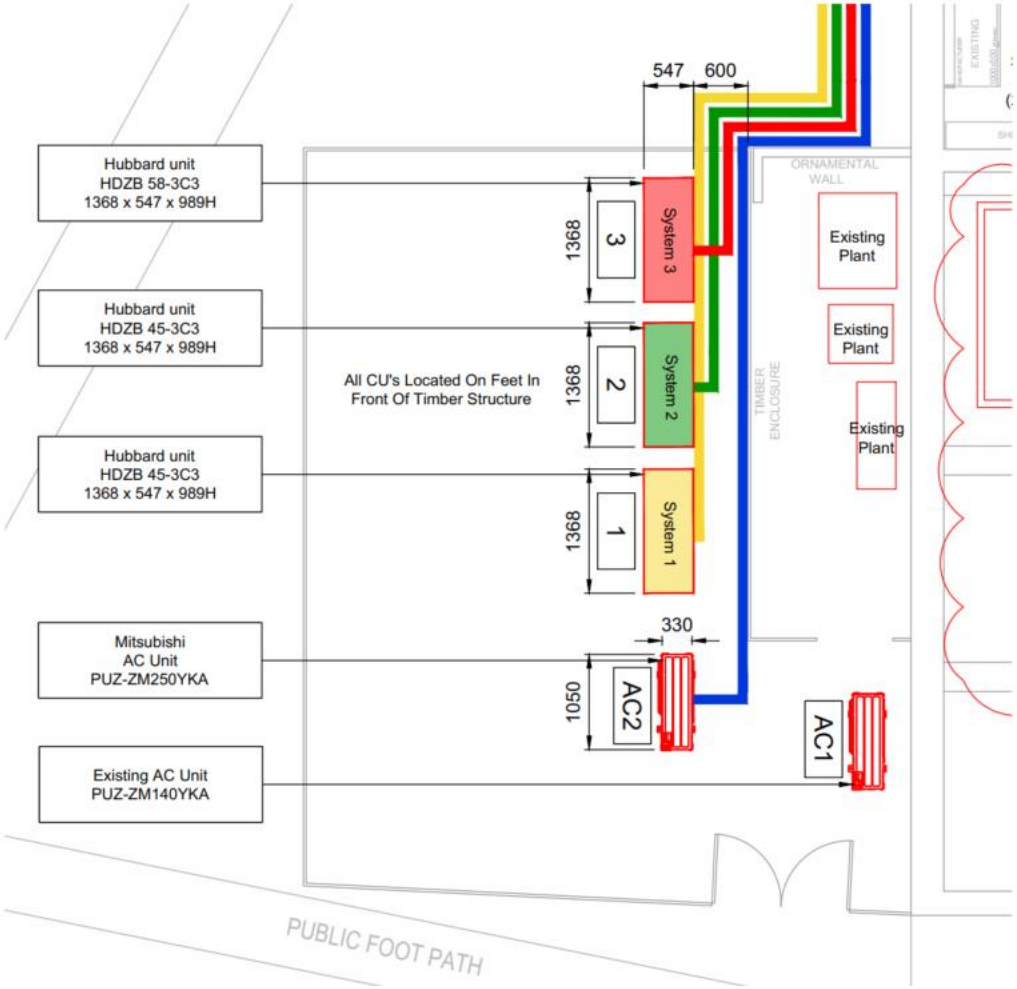
01:45
02:15
02:45
03:15
03:45
04:15
04:45
05:15
05:45
06:15
06:45
07:15
07:45
08:15
08:45
09:15
09:45
10:15
10:45
Night
LAeq (SR) [dB]
LAFmax (SR) [dB]
L10
L90

Appendix D Manufacturer noise data

Plant	Model / Unit	No. of units	Manufacturer noise level
AC1	Mitsubishi / PUZ-ZM140YKA	1	52dB at 1m
AC2	Mitsubishi / PUZ-ZM250YKA	1	62dB at 1m
System 1, 2, 3	Hubbard / HDZB 45-3C3	3	41dB at 10m

Appendix E Proposed plant layout



Appendix F Noise level predictions

Receptor R1

Daytime

Plant	Plant noise level at source		DISTANCE		DIRECTIVITY	SCREENING	BS4142 Feature Correction (dB)	RESULTANT AT RECEPTOR (dBA)
	Noise level (dBA)	Distance (m)	Distance (m)	Correction (dB)	Correction (dB)	Correction (dB)		
AC1	52	1	12	-22	0	-5	3	28
AC2	52	1	13	-22	0	-5	3	28
System 1	29	10	13	-2	0	-5	3	25
System 2	29	10	15	-4	0	-5	3	23
System 3	29	10	17	-5	0	-5	3	22
							CUMULATIVE:	33

Night-time

Plant	Plant noise level at source		DISTANCE		DIRECTIVITY	SCREENING	BS4142 Feature Correction (dB)	RESULTANT AT RECEPTOR (dBA)
	Noise level (dBA)	Distance (m)	Distance (m)	Correction (dB)	Correction (dB)	Correction (dB)		
System 1	29	10	13	-2	0	-5	3	25
System 2	29	10	15	-4	0	-5	3	23
System 3	29	10	17	-5	0	-5	3	22
							CUMULATIVE:	28

Receptor R2

Daytime

Plant	Plant noise level at source		DISTANCE		DIRECTIVITY	SCREENING	BS4142 Feature Correction (dB)	RESULTANT AT RECEPTOR (dBA)
	Noise level (dBA)	Distance (m)	Distance (m)	Correction (dB)	Correction (dB)	Correction (dB)		
AC1	52	1	40	-32	3	0	3	26
AC2	52	1	39	-32	3	0	3	26
System 1	29	10	39	-12	3	0	3	23
System 2	29	10	37	-11	3	0	3	24
System 3	29	10	35	-11	3	0	3	24
							CUMULATIVE:	32

Night-time

Plant	Plant noise level at source		DISTANCE		DIRECTIVITY	SCREENING	BS4142 Feature Correction (dB)	RESULTANT AT RECEPTOR (dBA)
	Noise level (dBA)	Distance (m)	Distance (m)	Correction (dB)	Correction (dB)	Correction (dB)		
System 1	29	10	39	-12	3	0	3	23
System 2	29	10	37	-11	3	0	3	24
System 3	29	10	35	-11	3	0	3	24
							CUMULATIVE:	28

Receptor R3

Daytime

Plant	Plant noise level at source		DISTANCE		DIRECTIVITY	SCREENING	BS4142 Feature Correction (dB)	RESULTANT AT RECEPTOR (dBA)
	Noise level (dBA)	Distance (m)	Distance (m)	Correction (dB)	Correction (dB)	Correction (dB)		
AC1	52	1	24	-28	3	-10	3	20
AC2	52	1	26	-28	3	-10	3	20
System 1	29	10	27	-9	3	-10	3	16
System 2	29	10	28	-9	3	-10	3	16
System 3	29	10	30	-10	3	-10	3	15
							CUMULATIVE:	25

Night-time

Plant	Plant noise level at source		DISTANCE		DIRECTIVITY	SCREENING	BS4142 Feature Correction (dB)	RESULTANT AT RECEPTOR (dBA)
	Noise level (dBA)	Distance (m)	Distance (m)	Correction (dB)	Correction (dB)	Correction (dB)		
System 1	29	10	27	-9	3	-10	3	16
System 2	29	10	28	-9	3	-10	3	16
System 3	29	10	30	-10	3	-10	3	15
							CUMULATIVE:	21