

The Co-operative
Wood Street
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**Plant Noise
Impact Assessment**

On behalf of



Project Reference: 92222 | Revision: - | Date: 17th April 2024

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Document Information

Project Name : The Co-operative, Wood Street, Earl Shilton
Project Reference : 92222
Report Title : Plant Noise Impact Assessment Report
Doc Reference : 92222/NIA
Date : 17th April 2024

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Revision	Date	Description	Prepared	Reviewed/ Approved

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1.0 Introduction

- 1.1. Noise Solutions Ltd (NSL) has been commissioned by City Building Engineering Services to provide a noise impact assessment of noise emissions for new, replacement plant serving the Co-operative store, located along Wood Street, Earl Shilton.
- 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. Cumulative plant noise emission levels for the plant have been predicted at what will be the most affected noise sensitive receptors and assessed following Hinckley and Bosworth Borough Council's typical requirements.
- 1.4. A glossary of acoustic terminology is given 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 standalone commercial unit to the south of Wood Street, Earl Shilton.
- 2.2. It is understood that two new items of refrigeration plant, and four new air conditioning units will be positioned externally, in the north eastern corner of the store's delivery yard.
- 2.3. Typically, the AC units run only when the store is open. Refrigeration plant may operate at any time to meet the store demands although it should be noted that demands are typically reduced in the evening and at night, when ambient temperatures are lower.
- 2.4. Acoustic wall lining is required at the internal north eastern corner of the delivery yard, to the rear of the proposed air conditioning units.

3.0 Nearest noise sensitive receptors

- 3.1. The store is located within a mixed residential, commercial and industrial area. The nearest noise sensitive receptors to the proposed plant, are the residential windows located along the east facing façade of the dwelling to the south west of the store (Receptor R1).
- 3.2. A site plan showing the site, surrounding area, nearest noise sensitive properties, and the noise monitoring location used in this assessment is presented in [Appendix C](#).

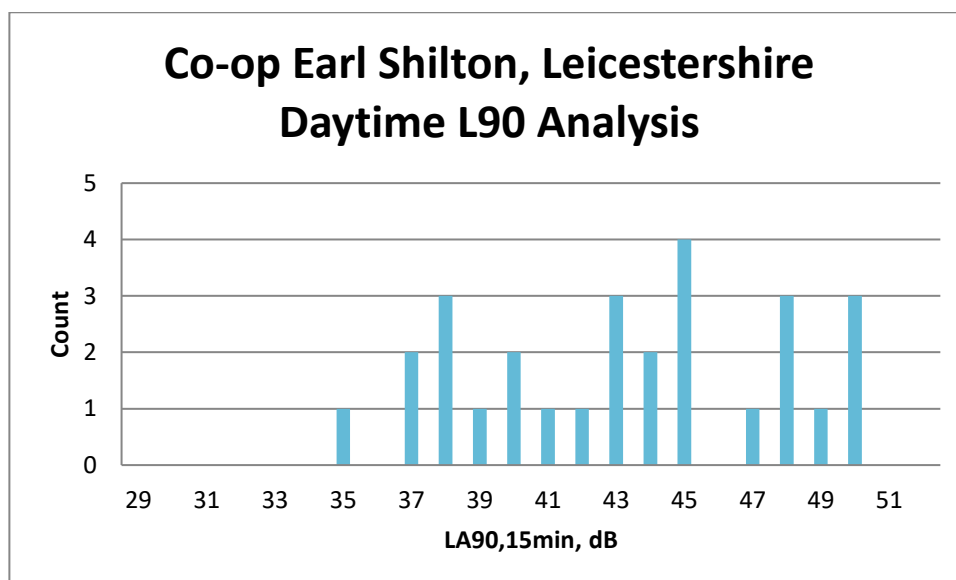
4.0 Existing noise climate

- 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 to the proposed plant area, during the quietest times at which the plant will operate.
- 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 D](#).

Table 1 Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	L _{Aeq} (15mins)	L _{AFmax} (15mins)	L _{A10} (15mins)	L _{A90} (15mins)
Daytime (07.00 – 23.00 hours)	42-60	56-79	45-63	35-50
Night-time (23.00 – 07.00 hours)	37-60	50-76	39-64	31-49

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



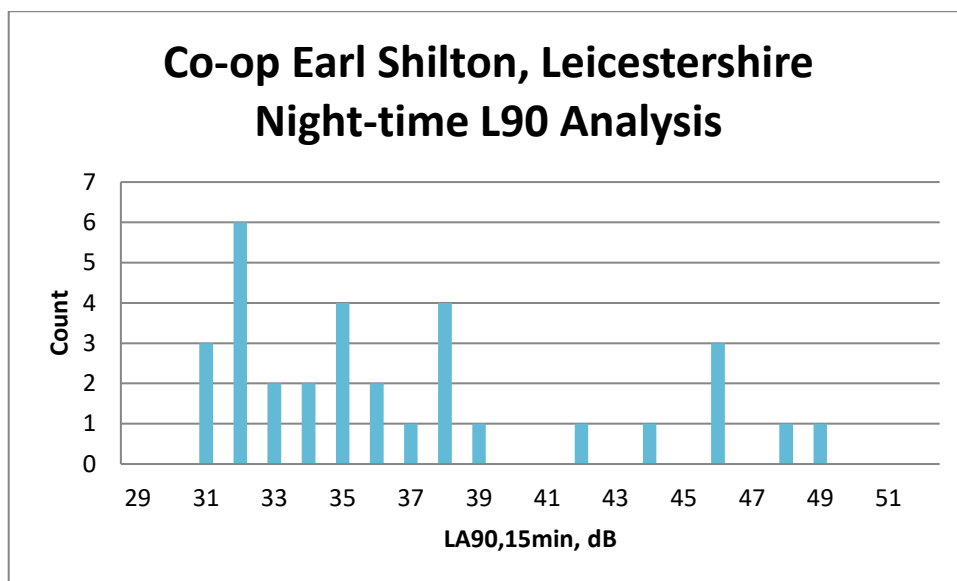
- 4.3. Further statistical analysis has been carried out on the data, and the mean, modal and median values are shown in Table 2 below.

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

dB, L_{A90} daytime period	
mean	43
modal	45
median	43

- 4.4. From the histogram analysis, and upon review of the time history graph located in [Appendix D](#), 39dB has been selected to be a robust representation of the background noise level during the daytime period.

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



- 4.5. Further statistical analysis has been carried out on the data and the mean, modal and median values are shown in Table 3 below.

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

dB, L_{A90} night-time period	
mean	37
modal	32
median	35

- 4.6. From the histogram analysis, and upon review of the time history graph located in [Appendix D](#), 32dB has been selected to be a robust representation of the background noise level during the night-time period.
- 4.7. Therefore, the following values are considered representative of the existing background sound pressure levels at nearby noise sensitive premises:

- 39dB L_{A90} during the daytime period; and
- 32dB L_{A90} during the night-time period.

5.0 Plant noise design criteria

Hinckley and Bosworth Borough Council

- 5.1. As part of a previous application, for an unrelated project, Hinckley and Bosworth Borough Council were contacted in order to ascertain their typical guidance with regard to plant noise emissions. It was confirmed that a BS 4142:2014 plant rating level, at the nearest noise-sensitive receptor, no higher than the existing representative background sound level would be acceptable.

BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

- 5.2. BS 4142:2014+A1:2019 is intended to be used to assess the likely effects of sound on people residing in nearby dwellings. The scope of BS 4142:2014 includes "sound from fixed plant installations which comprise mechanical and electrical plant and equipment".
- 5.3. The procedure contained in BS 4142:2014+A1:2019 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.
- 5.4. 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.
- 5.5. 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."
- 5.6. 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."
- 5.7. The assessment outcome results from a comparison of the rating level with the background sound level. The standard states:
- *Typically, the greater this difference, the greater the magnitude of the impact.*

- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;*
 - *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context;*
 - *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.*
- 5.8. The standard does state that "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."
- 5.9. 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."
- 5.10. 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."*
- 5.11. BS 4142:2014+A1:2019 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.

Proposed criteria

- 5.12. In accordance with the local authority's typical guidance, it is proposed that the rating level of the plant should not exceed the existing background noise level at the nearest receptor.
- 5.13. Therefore, it is recommended that the plant noise does not exceed the levels shown in Table 4.

Table 4 Plant noise emissions limits at the nearest noise sensitive receptor

Period	Cumulative plant noise rating level, dB(A)
Daytime (07.00 – 23.00 hours)	39
Night-time (23.00 – 07.00 hours)	32

- 5.14. 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 most affected noise sensitive receptor have been predicted based on manufacturer's noise data for the proposed equipment. The assessment has taken into consideration distance attenuation, directivity and screening.
- 6.1. It should be noted that none of the proposed plant is anticipated to exhibit any tonal or impulsive characteristics providing it is well maintained. The new proposed plant is inverter driven and, therefore, will gently ramp up and down depending on the demands placed upon the system.
- 6.2. Acoustic wall lining will be installed behind the air conditioning units to reduce reflected sound.
- 6.3. Table 5 summarises the results of the assessment at the most affected property. 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 E**.

Table 5 Assessment of predicted rating level at the nearest noise sensitive receptor

Receptor	Period	Predicted rating level at receptor, $L_{A,T,r}$ (dB)	Criterion (dB)	Difference
R1	Daytime (07.00 - 23.00 hours)	38	39	-1
	Night-time (23.00 - 07.00 hours)	18	32	-14

- 6.1. The noise level predictions demonstrate that, inclusive of the proposed acoustic wall lining, cumulative noise emissions from the proposed plant will comply with the proposed limits at the nearest noise sensitive properties.

Context and uncertainties

- 6.2. 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.
- Care was taken to ensure that the measurement position was representative of the noise climate outside the nearby residential dwellings and not in positions where higher noise levels were present.
- The above assessment is based on a minimum distance of around 33m between the proposed plant to the nearest receptor.
- Wall lining is to be affixed to the walls to the rear of the AC units.

6.3. 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.

7.0 Summary

- 7.1. Noise Solutions Ltd (NSL) has been commissioned by City Building Engineering Services to provide a noise impact assessment of noise emissions for new, replacement plant, serving the Co-operative store, located along Wood Street, Earl Shilton.
- 7.2. An environmental noise survey has been undertaken to establish the existing prevailing noise levels at a location representative of the noise climate outside the nearest noise sensitive receptors to the plant area.
- 7.3. Acoustic mitigation in the form of acoustic wall lining is proposed to be affixed to the walls to the rear of the air conditioning units.
- 7.4. The cumulative plant noise emission levels for the proposed plant have been predicted at the most affected noise sensitive receptor and determined to be in compliance with Hinckley and Bosworth Borough Council's usual requirements. Therefore, noise from the plant proposals should not be a reason for refusal of planning permission.

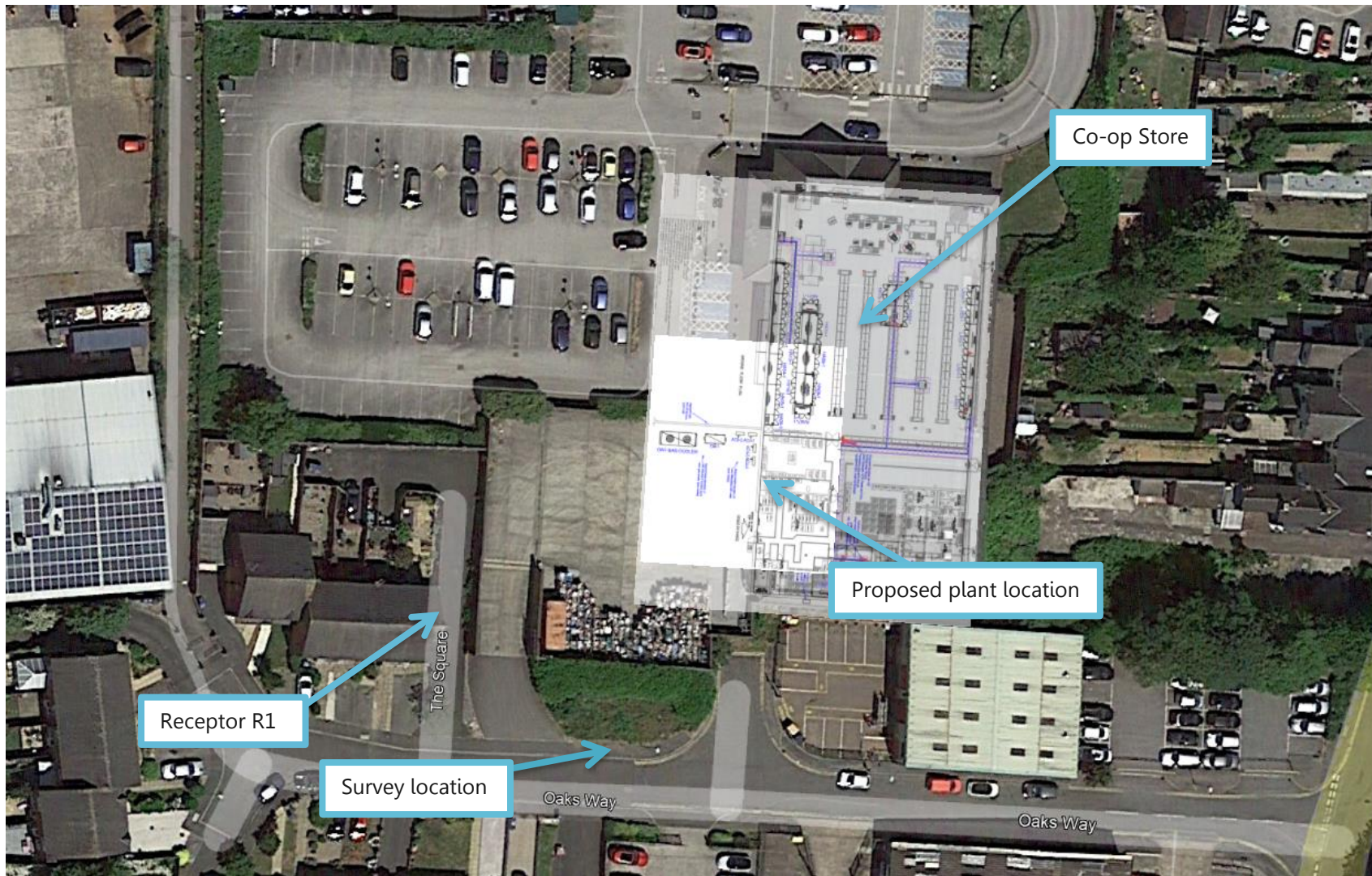
Appendix A Acoustic terminology

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 s_1 and s_2 is given by $20 \log_{10} (s_1/s_2)$. 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 $20\mu\text{Pa}$. 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 L_{eq} 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 Proposed plant details

Plant Item	Make/Model	Quantity	Sound pressure level (dBA)	
			Day	Night
Gas Cooler	Hubbard/ GF-ND102G32H-091R290	1	20dB at 10m	20dB at 10m
Refrigeration Pack	Hubbard/ GF-ND102G32H-091R290	1	20dB at 10m	20dB at 10m
ACU1,ACU2,ACU3,ACU4	Mitsubishi/ PUZ-M250YKA	4	62dB at 1m (each)	-

Appendix C Aerial photograph site showing areas of interest



Appendix D Environmental sound survey

Details of sound surveys

- D.1 Measurements of the existing background sound levels were undertaken between 18.00 hours on Tuesday 9th April and 09.00 hours on Wednesday 10th April 2024.
- D.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

- D.3 The representative measurement position was located on a lamppost on Oaks Way, to the south of the Co-op store (location indicated on the site plan in [Appendix C](#)).
- D.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

- D.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 in the calibration level was noted.

Environmental noise survey

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 977 / 36190	20/04/2023	1505154-2
Condenser microphone	ACO Pacific 7052E / 74975		
Preamplifier	Svantek SV12L / 10325		
Calibrator	Svantek SV33A / 73430	05/07/2023	1505854-1

Weather conditions

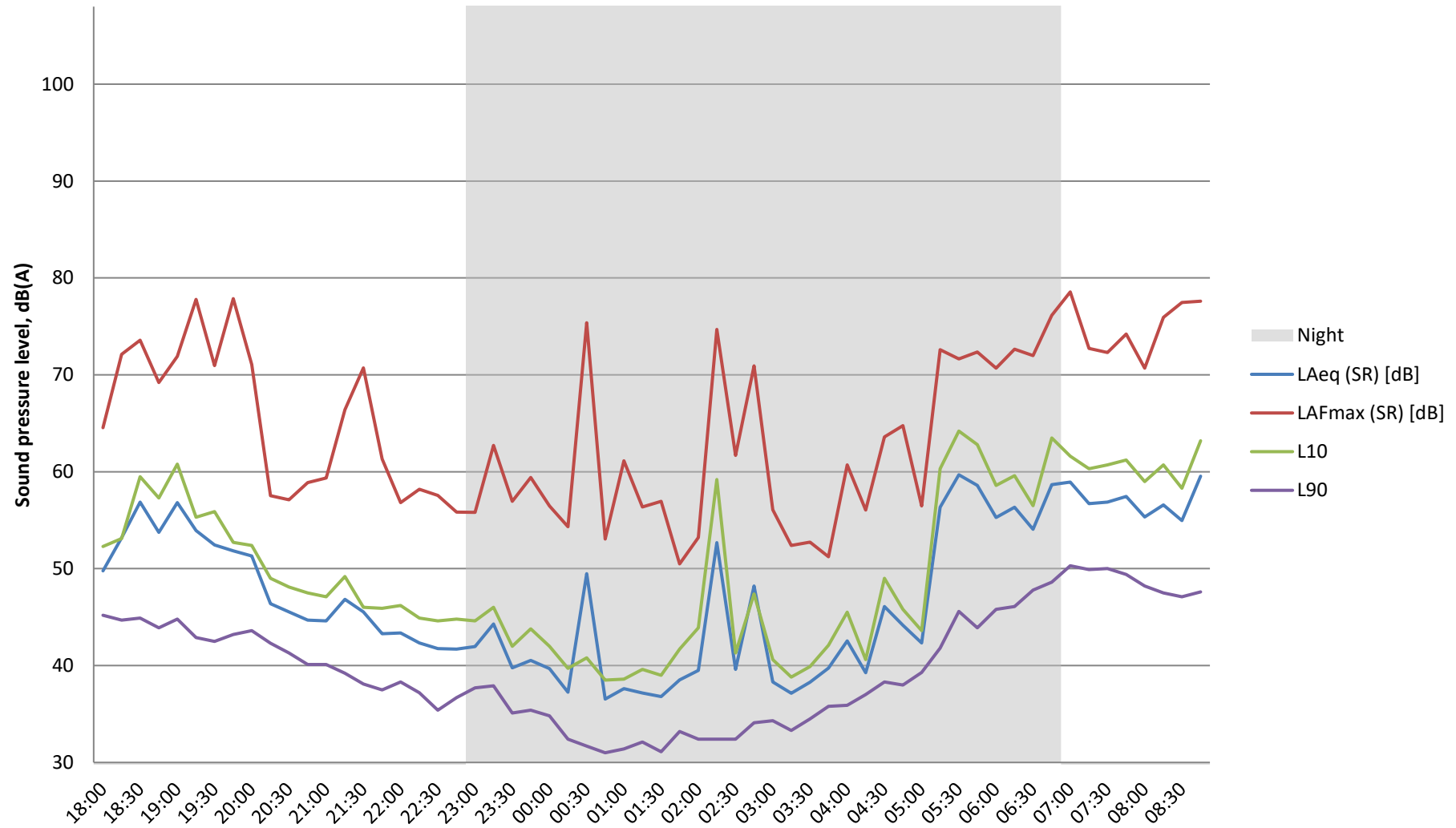
- D.6 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were generally appropriate for environmental noise measurements. The table below presents the weather conditions recorded on site at the beginning and end of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

Weather Conditions																						
Measurement Location	Date/Time	Description	Beginning of Survey	End of Survey																		
As indicated on Appendix C	18.00 9/4/24 - 09.00 10/4/24	Temperature (°C)	8	9																		
Cloud Cover Symbol Scale in oktas (eighths) 0 Sky completely clear 1 2 3 4 Sky half cloudy 5 6 7 8 Sky completely cloudy (9) Sky obstructed from view <tr><td>Precipitation:</td><td>No</td><td>No</td></tr> <tr><td>Cloud cover (oktas – see guide)</td><td>2</td><td>7</td></tr> <tr><td>Presence of fog/snow/ice</td><td>No</td><td>No</td></tr> <tr><td>Presence of damp roads/wet ground</td><td>Yes</td><td>No</td></tr> <tr><td>Wind Speed (m/s)</td><td>7</td><td>3</td></tr> <tr><td>Wind Direction (from)</td><td>NW</td><td>E</td></tr> <tr><td>Conditions that may cause temperature inversion (i.e. calm nights with no cloud)</td><td>No</td><td>No</td></tr>		Precipitation:	No	No	Cloud cover (oktas – see guide)	2	7	Presence of fog/snow/ice	No	No	Presence of damp roads/wet ground	Yes	No	Wind Speed (m/s)	7	3	Wind Direction (from)	NW	E	Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No
		Precipitation:	No	No																		
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		Presence of fog/snow/ice	No	No																		
		Presence of damp roads/wet ground	Yes	No																		
		Wind Speed (m/s)	7	3																		
		Wind Direction (from)	NW	E																		
Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No																				

Results

- D.7 The results of the environmental survey are considered to be representative of the background sound pressure levels at the façades of the nearest noise sensitive receptors during the quietest times at which the plant will operate. Upon the setup and collection of the noise level meter, the noise climate was dominated by distant and local road traffic, with occasional noise from aircraft, pedestrians, wind and birdsong.
- D.8 Although high winds were noted at the start of the surveyed period, review of the time history graph does not indicate that the results of the survey were adversely impacted.
- D.9 The results of the survey are presented in a time history graph overleaf.

Co-op Earl Shilton, Leicestershire Tuesday 09 - Wednesday 10 Apr 2024



Appendix E Noise level predictions

Receptor R1 Daytime

Plant	Maximum plant noise level at source		Distance		Directivity (dB)	Screening (dB)	BS 4142:2014 feature correction	Plant rating noise level at receptor (dBA)
	L _p (dBA)	Distance (m)	Distance (m)	Correction (dB)				
Pack	20	10	38	-12	3	0	3	14
Gas Cooler	20	10	33	-10	3	0	3	16
ACU-1	62	1	43	-33	0*	0	3	32
ACU-2	62	1	42	-32	0*	0	3	33
ACU-3	62	1	43	-33	0*	0	3	32
ACU-4	62	1	42	-32	0*	0	3	33
Cumulative rating level								38

**Acoustic Wall lining to be affixed to walls to the rear of AC units*

Plant	Maximum plant noise level at source		Distance		Directivity (dB)	Screening (dB)*	BS 4142:2014 feature correction	Plant rating noise level at receptor (dBA)
	L _p (dBA)	Distance (m)	Distance (m)	Correction (dB)				
Pack	20	10	38	-12	3	0	3	14
Gas Cooler	20	10	33	-10	3	0	3	16
Cumulative rating level								18

Appendix F Proposed plant location

