

The Co-operative
Winchester Road
Chandler's Ford
SO53 2GH

**Plant Noise
Survey (2)**

On behalf of



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For and on behalf of Noise Solutions Ltd				

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1.0 Introduction

- 1.1. Noise Solutions Ltd (NSL) has been commissioned by Epta to undertake a survey to establish noise emissions from new plant serving the Co-operative store located on Winchester Road in Chandler's Ford.
- 1.2. NSL have attended the site to undertake plant noise readings at the plant area and at receiver R1 and R2 to determine compliance, or otherwise, with local authority requirements.
- 1.3. It should be noted that NSL previously attended site prior to the plant being correctly commissioned (NSL Plant Noise Survey report ref 91133/PNS dated 29th November 2023 refers). The results of this survey and report suggested that plant noise emissions did not comply with local authority requirements, however, the refrigeration plant had not been commissioned and fan duties had been left unrestricted. Limitations on fan speed have now been imposed as per the original design, such that the refrigeration gas cooler fans cannot run above 50% duty.
- 1.4. A glossary of acoustic terminology is given in [Appendix A](#).

2.0 Site details

- 2.1. The Co-operative store occupies a unit within the commercial building located on Winchester Road in Chandler's Ford, Eastleigh. The new refrigeration and air conditioning (VRF) plant is located within an internal plantroom with louvres terminating along the north façade of the building.
- 2.2. It was confirmed that VRF operates only during the daytime.
- 2.3. The engineer on the site confirmed that the gas cooler operating control voltage has now been restricted such that it cannot operate above 50% of its maximum capacity.

3.0 Nearest noise sensitive receptors

- 3.1. The area surrounding the site is mixed residential and commercial in nature.
- 3.2. The nearest and potentially most affected noise-sensitive receptor to the plantroom louvres are the flats (Receptor R1) above the commercial units east of the site. These windows are approximately 27m from the intake and discharge louvres.
- 3.3. There are also houses (Receptor R2) west of the site on Brownhill Road, with windows approximately 23m from the plantroom louvres.
- 3.4. [Appendix B](#) contains an aerial photograph showing the site and surrounding area.

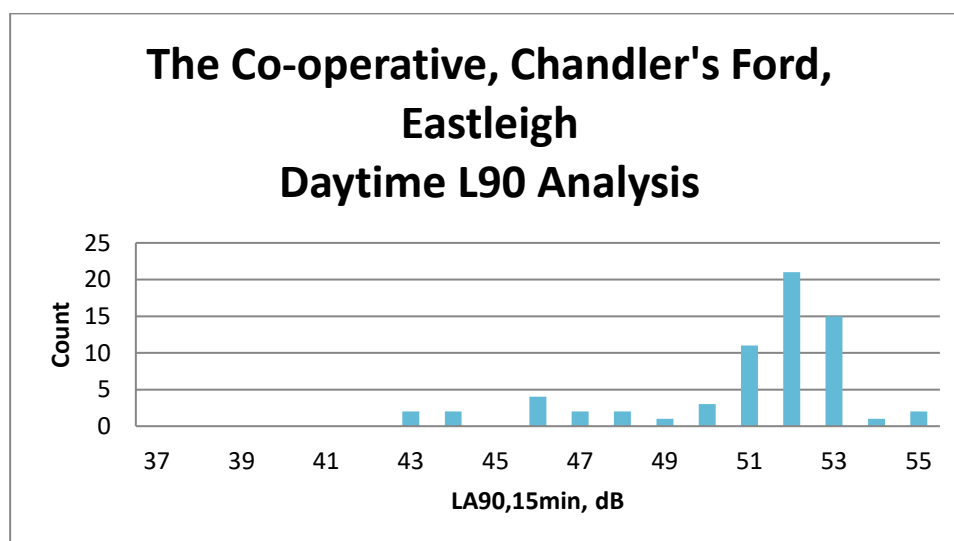
4.0 Existing noise climate

- 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 plant 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 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)	50-69	70-103	51-68	43-55
Night-time (23.00 – 07.00 hours)	42-59	59-79	43-60	37-51

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



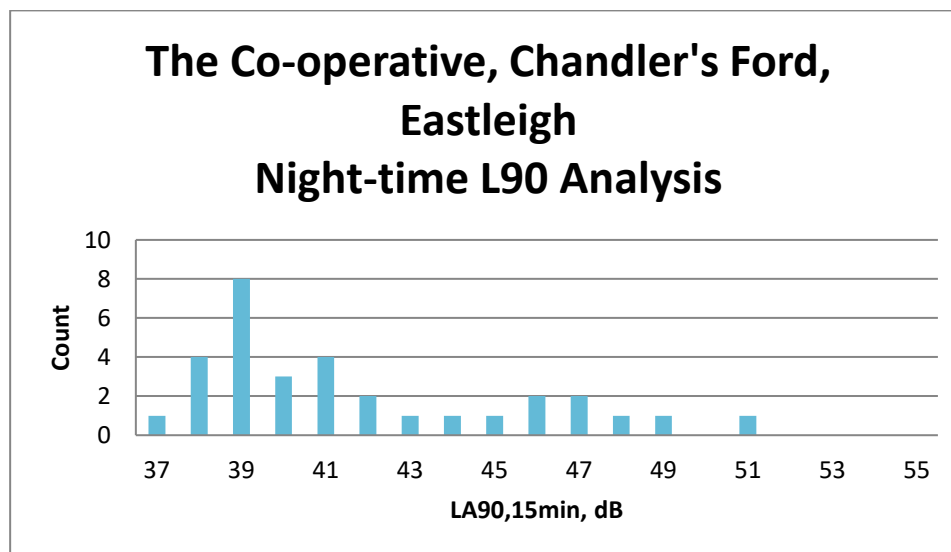
- 4.3. Further statistical analysis has been carried out on the data, and the mean, mode and median values are shown in Table 2 below.

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

dB, L _{A90} daytime period	
mean	51
modal	52
median	52

- 4.4. From the histogram analysis, 43dB 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, mode 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	42
modal	39
median	40

- 4.6. Again, from the histogram analysis, 37dB has been selected to be a robust representation of the background sound 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:
- 43dB L_{A90} during the daytime period; and
 - 37dB L_{A90} during the night-time period.

5.0 Plant noise design criteria

Eastleigh Borough Council

- 5.1. Eastleigh Borough Council's noise limit requirements are worded as follows:

Prior to commencement of the development, details shall be submitted to and approved in writing by the Council, of the external sound level emitted from plant/ machinery/ equipment and mitigation measures as appropriate. The measures shall ensure that the external sound level (Rating Level) emitted from plant, machinery/ equipment will be lower than the lowest existing background sound level by at least 10dBA to prevent any adverse

impact. The assessment shall be made in accordance with BS4142:2014 at the nearest and/or most affected noise sensitive premises, with all machinery operating together at maximum capacity. A post-installation noise assessment shall be carried out where required to confirm compliance with the sound criteria and additional steps to mitigate noise shall be taken, as necessary. Approved details shall be implemented prior to occupation of the development and thereafter be permanently retained.

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 4142:2014¹ includes *"sound from fixed plant installations which comprise mechanical and electrical plant and equipment"*.
- 5.3. The procedure contained in BS 4142:2014 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;*

¹ For brevity, references to BS 4142 and BS 4142:2014 should be read as BS 4142:2014 + A1:2019

- *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 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.

Summary of applicable emissions criteria

- 5.12. In order to meet the local authority's emissions criterion, the cumulative plant noise rating level of the proposed plant items would need to be controlled to a level that does not exceed 10dB below the lowest L_{A90} background sound level at the nearest residential property.
- 5.13. Plant noise levels should therefore not exceed the following limits:

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

Receptor	Period	Cumulative plant rating level, dB(A)
Residential	Daytime (07.00 – 23.00 hours)	33
	Night-time (23.00 – 07.00 hours)	27

6.0 Plant noise survey and assessment

Plant noise survey methodology

- 6.1. Noise Solutions Ltd attended site between 19.00 and 20:30 hours on Monday 15th January 2024 to measure noise emissions from the plant installed at the store.
- 6.2. Measurements of sound pressure levels were undertaken close to the louvres only due to the low noise emissions of the plant. It was not possible to accurately measure noise from plant at the nearest receptors since noise from environmental sources was dominant at these locations. Predictions to those receptors were made based on measurements made closer to the louvres.
- 6.3. Measurements were taken with all plant running and of individual plant items, with the refrigeration gas cooler operating on maximum duty (50% of max fan speed). Noise measurements were also taken with the plant items switched off.
- 6.4. Measurements of plant noise emissions were undertaken over short durations (30 seconds) to minimise the influence of extraneous sources (e.g., car pass-bys, passing aircraft, etc.).
- 6.5. Both broadband and one-third octave band frequency data was measured. The measured L_{A90} noise measurements have been used in this assessment since noise from the plant was constant during operation and, again, this minimised influence from extraneous sources.
- 6.6. Details of the noise monitoring equipment used during the survey are detailed in the following table.

Table 5 Details of noise monitoring equipment

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 977D / 99071	11/05/2023	Factory conformation certificate
Condenser microphone	ACO Pacific 7052E / 81197		
Preamplifier	Svantek SV18A / 130661		
Calibrator	Svantek SV 33B / 83850	30/10/2023	1506985-2

- 6.7. Weather conditions during the survey were wet with a clear sky and a temperature of -1°C. Road surfaces in the surrounding area were dry. Weather conditions were unlikely to have affected the results of the plant noise survey.

Results

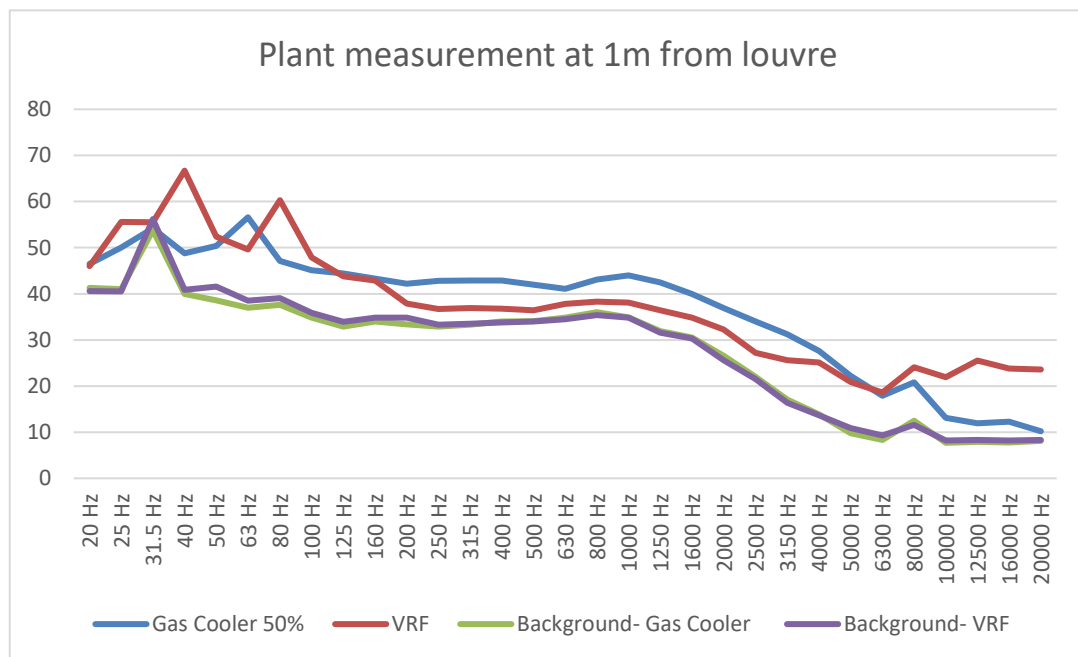
- 6.8. The measured levels have been corrected based on residual sound levels, screening and distance in order to determine the specific plant noise level for each item at the receptors. A full set of calculations is presented in [Appendix D](#).

- 6.9. As detailed in BS 4142:2014, feature corrections should be applied to the measured specific noise levels where applicable. An analysis of the measured frequency data (in accordance with the methodology outlined in Annex C of BS 4142:2014) with the equipment operating at their maximum allowable duty indicates that the plant is perceptible and tonal (spectral data provided in Figure 3 below).
- 6.10. Based on the above considerations, the following acoustic feature corrections have been applied to the measured specific noise levels of the plant serving the store and summarised in below.

Table 6 Acoustic feature corrections applied to the measured plant

BS 4142:2014 acoustic features	Penalties applied on plant items	
	VRF	Gas cooler & Pack
Tonality	+2	+2
Impulsivity	0	0
Intermittency	0	0
Other acoustic features	0	0
Total	+2	+2

Figure 3 Spectral noise data with equipment operating at maximum allowable duty



- 6.11. assesses the worst-case plant noise rating levels at Receptors R1 and R2 with the plant operating at measured duty against the daytime and night-time emissions criteria established within Table 4. Sound levels have been calculated by correcting measured sound levels at 1m from the louvres for distance and screening to the receptors.

Table 7 Assessment of plant noise levels at Receptors

Receptor	Assessment period	Sound pressure level, L_{A90} (dB)	Emissions criterion, L_{Aeq} (dB)	Difference (dB)
R1	Daytime (07.00 – 23.00 hours)	16	33	-17
	Night-time (07.00 – 23.00 hours)	15	27	-12
R2	Daytime (07.00 – 23.00 hours)	27	33	-6
	Night-time (07.00 – 23.00 hours)	26	27	-1

- 6.12. The results of the assessment indicate that at the window of both receptors, noise emissions from the plant items when operating at their design duty meets the local authority criteria.
- 6.13. Where possible uncertainty in this assessment has been minimised by taking the following steps:
- All sound level meters and calibrators used have a traceable laboratory calibration and were field calibrated before and after the measurements.
 - Uncertainty in the calculated impact has been reduced by the use of a well-established method.

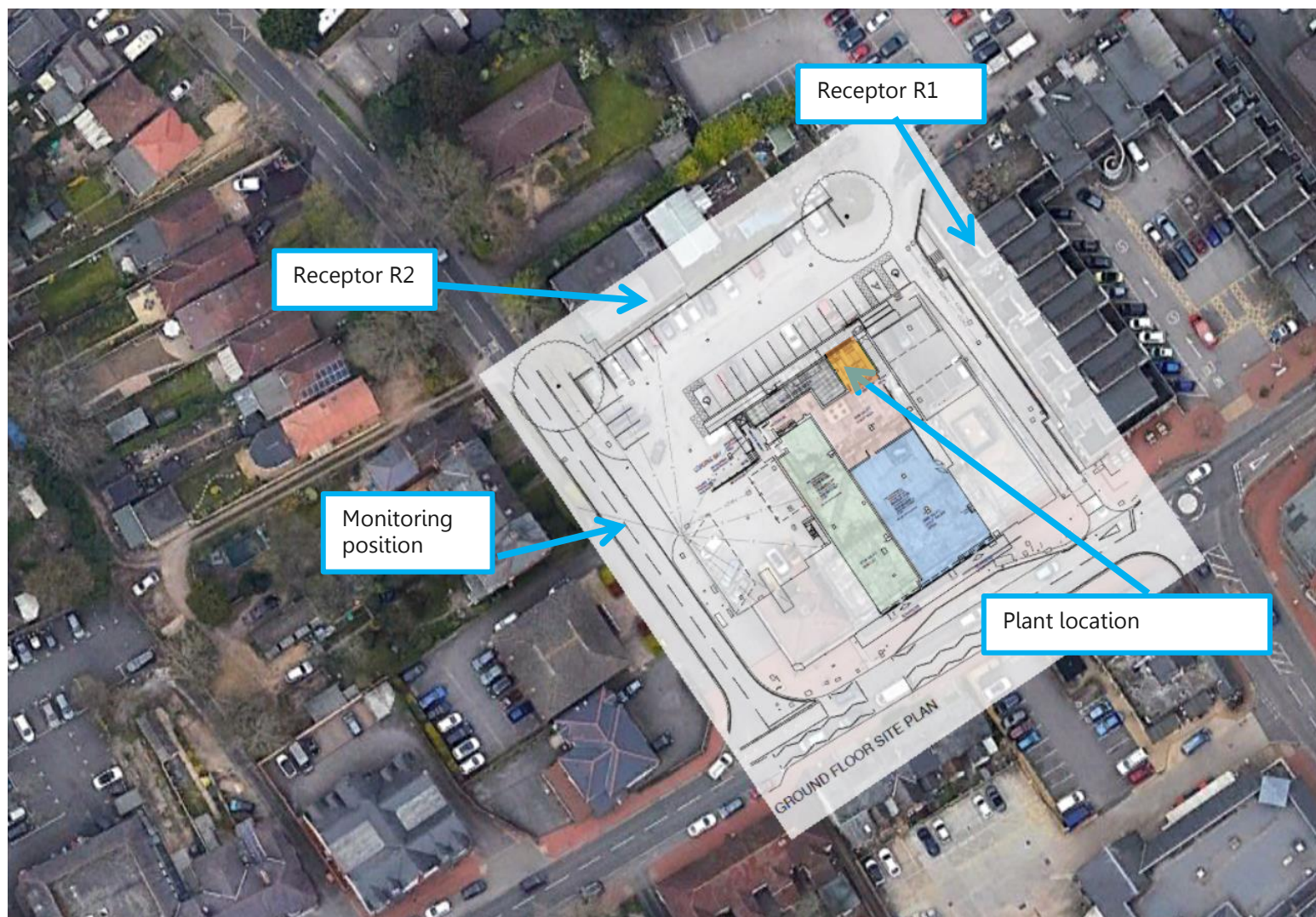
7.0 Summary

- 7.1. Noise Solutions Ltd (NSL) has been commissioned by Epta to undertake a noise survey to establish noise emissions from plant serving the Co-operative store located on Winchester Road in Chandler's Ford.
- 7.2. NSL have attended site to undertake plant noise readings externally in order to determine compliance, or otherwise, with local authority requirements.
- 7.3. The testing has determined that the noise emissions criteria are met at the identified noise-sensitive receptors.

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 Photograph of site showing areas of interest



Appendix C Environmental noise survey

Details of environmental sound surveys

- C.1 Measurements of the existing background sound levels were undertaken between 11.45 hours on Thursday 3rd November and 12.15 hours on Friday 4th November 2022.
- 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 fifteen-minute sample periods for the duration of the survey.

Measurement position

- C.3 The representative measurement position was located on a lamppost on Brownhill Road west of the site (location indicated on the site plan in [Appendix B](#)). In accordance with BS 7445-2:21991 '*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.4 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 (+/-0.3 dB) in the calibration level was noted.

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 971A / 124655	26/07/2022	Factory conformation certificate
Condenser microphone	ACO Pacific 7152 / 84710		
Preamplifier	Svantek SV18A / 126200		
Calibrator	Svantek SV33B / 125706	09/09/2022	Factory conformation certificate

- C.5 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were 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	11.45 3 Nov - 12.15 4 Nov 2022	Temperature (°C)	11	12
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		Precipitation:	Yes	No
		Cloud cover (oktas - see guide)	8	2
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	Yes	Yes
		Wind Speed (m/s)	0	<1
		Wind Direction	-	NE
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

Results

- C.6 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 to the plant area during the quietest times at which the plant will operate. The predominant noise source affecting the area was local traffic. The results of the survey are presented in a time history graph overleaf. The results of the survey are presented in a time history graph overleaf.

The Co-operative, Chandler's Ford, Eastleigh Thursday 03 - Friday 04 Nov 2022



Appendix D Noise measurements and calculations

Receptor	Plant Item	Measurement distance (m)	Ambient noise level (dBA)	Residual noise level (dBA)	Specific noise level (dBA)	Distance to receptor (m)	Distance correction (dBA)	Screening	BS 4142 feature correction (dBA)	Resultant at receptor (dBA)
R1	Gas Cooler	1	52	43	51	27	-29	-10	2	15
	VRF	1	48	42	46	27	-29	-10	2	9
	Combined rating level at Receptor, daytime									16
	Combined rating level at Receptor, night-time									15
R2	Gas Cooler	1	52	43	51	23	-27	0	2	26
	VRF	1	48	42	46	23	-27	0	2	21
	Combined sound pressure level at Receptor, daytime									27
	Combined sound pressure level at Receptor, night-time									26