

The Co-operative
29-35 School Road
Tilehurst
Reading
RG31 5AR

**Plant Noise
Impact Assessment**

On behalf of



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For and on behalf of Noise Solutions Ltd				

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Executive Summary

Noise Solutions Limited has been appointed to provide a noise impact assessment for new plant to be installed at the Co-operative store on School Road in Tilehurst.

Plant will be installed within a plantroom, with intake and discharge louvres on the south elevation of the building.

The assessment shows that noise from the plant will comply with the local authority's usual requirements and should therefore be acceptable to them.

1.0 Introduction

- 1.1. Noise Solutions Ltd (NSL) has been commissioned to provide a noise impact assessment for new plant serving the Co-operative store on School Road in Tilehurst.
- 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 Co-operative store occupies an end-terrace property on School Road in Tilehurst, adjacent to the junction with Recreation Road.
- 2.2. New plant will be located in an internal plantroom with intake and discharge louvres in the south elevation. Plant will comprise an air conditioning (AC) unit and refrigeration plant. The refrigeration plant will run at all times; the AC unit will operate only when the store is open.

3.0 Nearest noise sensitive receptors

- 3.1. The area around the site is a mix of commercial and residential properties, with shops to the east, a petrol station and offices to the north, houses to the west and a car park to the south.
- 3.2. The nearest existing noise-sensitive receptors are houses to the south west on Recreation Road, approximately 22m from the plant ventilation louvres. It is understood, however, that it is proposed to redevelop the floor above the store to provide new flats (Receptor R1), and these would therefore be the closest residential windows. These would be approximately 4m from the louvres.
- 3.3. A site plan showing the site and surrounding area and noise monitoring location used in this assessment, and photographs of the above receptors, are presented in [Appendix B](#).

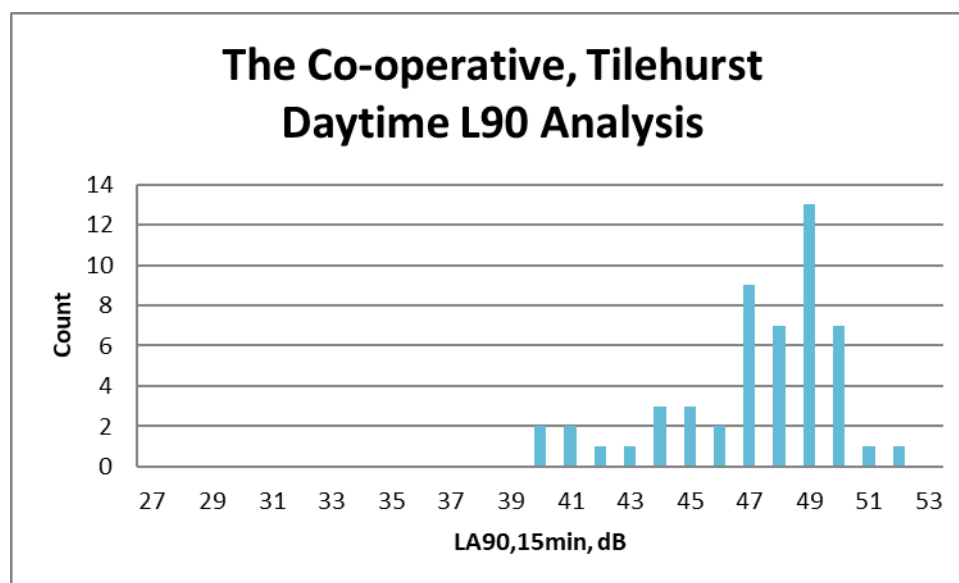
4.0 Existing noise climate

- 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 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 C](#).

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)	47-60	62-82	48-62	40-52
Night-time (23.00 – 07.00 hours)	34-58	52-81	33-60	28-45

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



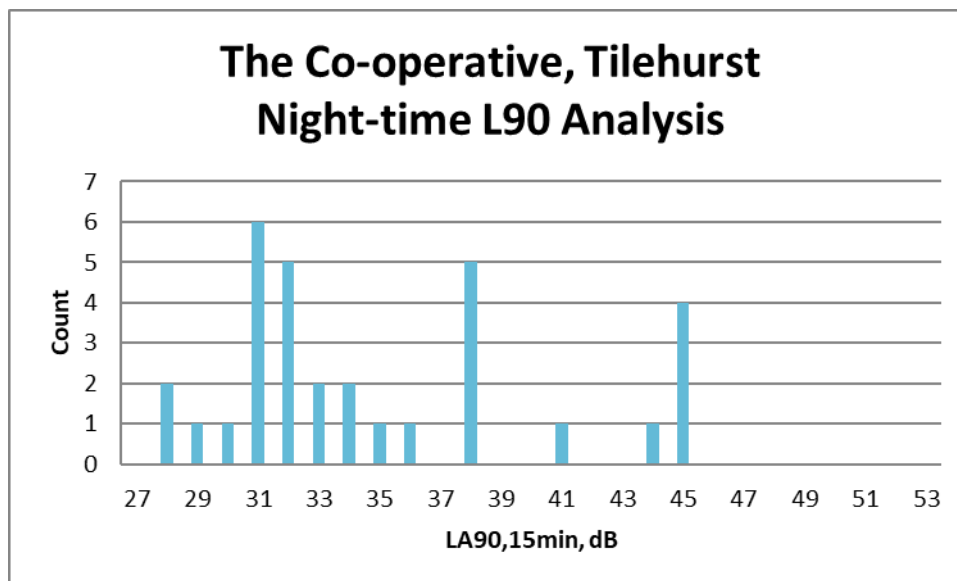
- 4.3. Further statistical analysis has been carried out on the data, and the mean and median values are shown in Table 2 below.

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

dB, L _{A90} daytime period	
mean	47
modal	49
median	48

- 4.4. In order to be robust, 45dB has been selected to be representative 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 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	35
modal	31
median	33

- 4.6. In order to be robust, 31dB has been selected to be representative of the background sound level in the area.
- 4.7. Therefore, the following values are considered representative of the existing background sound pressure levels at nearby noise sensitive premises:
- 45dB L_{A90} during the daytime period; and
 - 31dB L_{A90} during the night-time period.

5.0 Plant noise design criteria

Reading Borough Council

- 5.1. For similar applications for fixed plant, Reading Borough Council usually applies the following Condition:

"The rating level of the plant/equipment hereby approved, $L_{Ar,Tr}$ (specific sound level plus any adjustment for the characteristic features of the sound) as measured at a point 1 metre external to sensitive facades, shall be at least 10 dB below the existing background sound level, $L_{A90,T}$ when all plant/equipment (or any part of it) is in operation.

Reason: To safeguard the amenities of the adjoining premises and the area generally, in accordance with Policy CS34 of the Reading Borough LDF Core Strategy 2008 (Altered 2015) and Policy DM4 of the Reading Borough LDF Sites and Detailed Policies Document 2012 (Altered 2015)"

- 5.2. The reference to "rating" and " $L_{Ar,Tr}$ " implies that the assessment is to be made using the methodology set out in BS 4142:2014.

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

- 5.1. 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+A1:2019 includes "sound from fixed plant installations which comprise mechanical and electrical plant and equipment".
- 5.2. 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.
- 5.3. 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.
- 5.4. 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."
- 5.5. 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."
- 5.6. 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.*
- 5.7. 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."
- 5.8. 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."
- 5.9. 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."*
- 5.10. 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.

Low background sound levels

- 5.11. In view of the low night-time background sound levels, and as described in BS 4142:2014, it is proposed that noise from the new plant is limited to a rating level of 30 dB(A) outside the nearest residential windows at night. This would typically result in an internal noise level of around 15 dB(A) with windows open, a level below that produced by refrigerators and similar items within the nearest houses.

Proposed criteria

- 5.12. Based on the above criteria the noise rating level for the proposed plant at the nearest residential windows should be at least 10dB below the existing representative background sound level, with a lower limit of 30dBA, and should therefore not exceed the limits in the table below.

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)	35
Night-time (23.00 – 07.00 hours)	30

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

6.0 Plant noise impact assessment

- 6.1. The cumulative plantroom louvre noise levels at the nearest noise sensitive receptors have been predicted. Predictions are based on the manufacturer noise data given in [Appendix D](#).
- 6.2. The assessment has considered the reverberant conditions within the plantroom, the aperture size, directivity, any screening between source and receivers and distance attenuation. The predictions have been based on the proposed refrigeration operating at full capacity during both the daytime and night-time periods.
- 6.3. Predictions are inclusive of the following atmospheric attenuators fitted to the plant room louvres:

Table 5 Proposed attenuators to plant room louvres

Attenuator	Insertion loss (dB) at octave band centre frequencies (Hz)							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Intake	13	26	40	45	45	45	45	45
Gas cooler discharge	13	26	40	45	45	45	45	45
VRF discharge	13	26	40	45	45	45	45	45

- 6.5. Plant is not expected to be tonal and will be inverter controlled such that the operating duty ramps up and down as demand dictates. 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...".

- 6.6. Table 6 summarises the results of the assessment at the most affected receptors. All other nearby receptors benefit from increased distance/screening to the plant. The full set of calculations can be found in **Appendix F**.

Table 6 Assessment of predicted noise levels at nearest receptors

Receptor	Period	Predicted rating level at receptor, $L_{A,r,Tr}$ (dB)	Proposed design criterion (dB)	Difference (dB)
R1, residential	Daytime (07.00 – 23.00 hours)	35	35	0
	Night-time (23.00 – 07.00 hours)	25	30	-5
R2, residential	Daytime (07.00 – 23.00 hours)	19	35	-16
	Night-time (23.00 – 07.00 hours)	14	30	-16

Uncertainties

- 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.
 - Care was taken to ensure that the measurement positions were representative of the noise climate outside the nearby residential dwellings and not in positions where higher noise levels were present.
- 6.8. The following should be taken into account during the design of the refrigeration systems:
- The local authority is anticipated to require details of the proposed plant and a noise impact assessment report as part of the planning application.

Noise and vibration transmission

- 6.9. Subject to review of the construction of the separating floor between the plantroom and the proposed apartments above, it is likely that a mass-layer ceiling will be required to control airborne sound transmission to acceptable levels.

- 6.10. To control structure-borne noise and vibration transmission, all plant must be suitably isolated from the building structure.

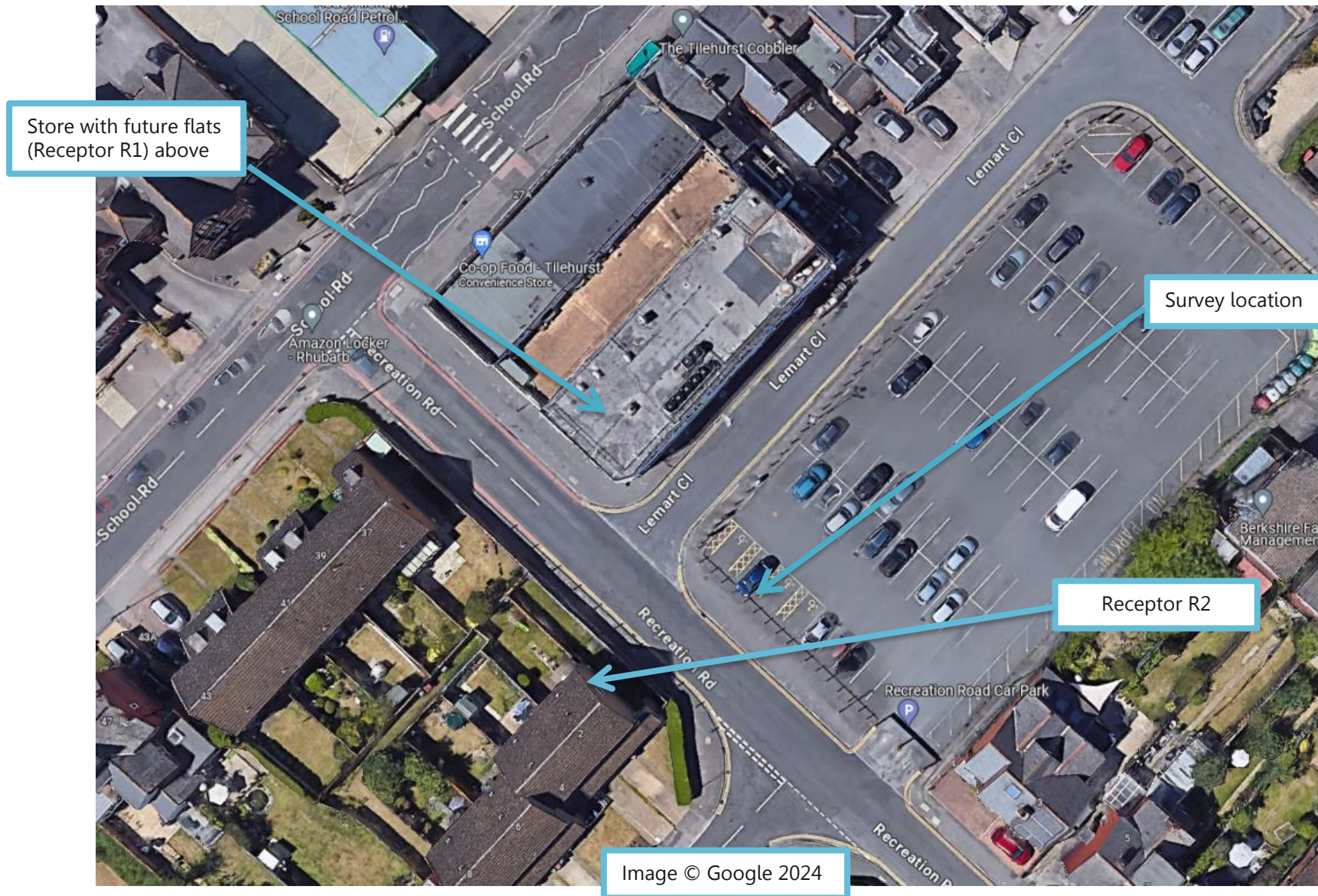
7.0 Summary

- 7.1. Noise Solutions Ltd (NSL) has been commissioned to provide a noise impact assessment for new plant serving the Co-operative store on School Road in Tilehurst.
- 7.2. An environmental noise survey has been undertaken to establish the existing prevailing noise levels at locations representative of the noise climate outside the nearest noise sensitive receptors to the proposed plant area.
- 7.3. The assessment shows that plant noise will comply with the local authority's usual requirements, inclusive of suitable attenuators being fitted to the plant room apertures. 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 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 sound survey

Details of sound survey

- C.1 Measurements of the existing background sound levels were undertaken between 13.30 hours on Tuesday 27th February and 10.30 hours on Wednesday 28th February 2024.
- 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 representative measurement position was located on a lamppost on Recreation Road (location indicated on the site plan in [Appendix B](#)).
- 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	Rion NL-52 / 00654035	06/07/2023	TCRT23/1489
Condenser microphone	Rion UC-59 / 14826		
Preamplifier	Rion NH-25 / 87474		
Calibrator	Rion NC-74 / 34235932	06/10/2023	1506701-1

Weather Conditions

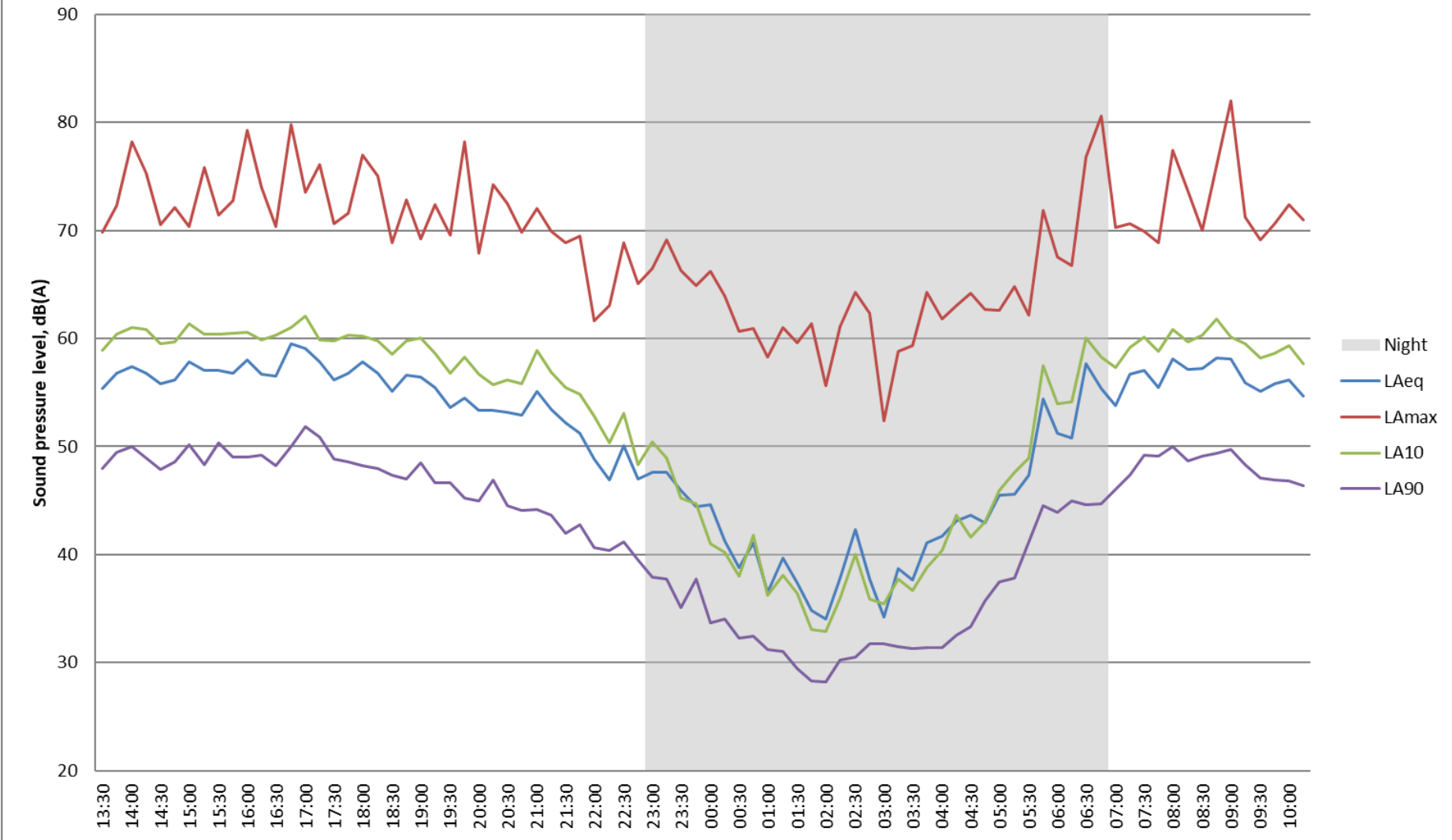
- C.6 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were appropriate for environmental noise measurements. The table below presents the weather conditions recorded on site at the beginning and end of the survey.

Weather Conditions				
Measurement Location	Date/Time	Description	Beginning of Survey	End of Survey
As indicated on Appendix B	13.30 27 Feb - 10.30 28 Feb 2024	Temperature (°C)	9	7
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:	No	No
		Cloud cover (oktas - see guide)	5	8
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	Damp	Damp
		Wind Speed (m/s)	2	2
		Wind Direction	SW	S
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

Results

- C.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. The noise climate during the survey period was observed to be due to a mix of distant and local traffic, with aircraft occasionally audible. The results of the survey are presented in a time history graph overleaf.

The Co-operative, Tilehurst Tuesday 27 - Wednesday 28 Feb 2024



Appendix D Plant noise data

Plant	Unit/Model	No. of units	Description	Sound power level (dB) at octave band centre frequencies (Hz)								
				63	125	250	500	1000	2000	4000	8000	dBA (dB)
Gas cooler	Coolers and Condensers/GFH A1-126AL-EC50-H3	1	Intake L _w (daytime)	68	63	56	58	64	60	52	43	66
			Discharge L _w (daytime)	74	69	62	64	70	66	58	49	72
			Intake L _w (night-time)	68	63	56	58	64	60	52	43	66
			Discharge L _w (night-time)	74	69	62	64	70	66	58	49	72
Pack	Hubbard	1	Sound power level	84	78	80	75	72	69	65	57	78
VRF	Mitsubishi/PUHY-M300YNW-A1	1	Sound power level	88	86	86	83	77	73	68	63	84

Appendix E Noise level predictions

Summary

Summary of results	R1		R2	
	Day	Night	Day	Night
Intake Louvre	24	22	15	13
Gas Cooler Discharge Louvre	22	22	5	5
VRF	34		17	
Cumulative	35	25	19	14
Target	35	30	35	30
Excess	0	-5	-16	-16

Appendix F Plant noise calculations

F.1 Daytime

F.1

Description	Notes	Sound level (dB) at octave band centre frequency								LAeq (dB)
		63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
Plant room										
Intake										
Reverberant level in plant room	Rev Lp	80	76	77	72	66	61	57	50	74
All plant running										
Opening area (m2)	7.16	9	9	9	9	9	9	9	9	
SRI of opening	I.L	-13	-26	-40	-45	-45	-45	-45	-45	
Inside-outside correction		-6	-6	-6	-6	-6	-6	-6	-6	
Lw of opening	Lw	70	52	40	30	24	19	14	7	45
R1										
Directivity correction	(4770,90deg x 1500,0deg)	-5	-5	-8	-7	-7	-7	-7	-7	
Distance correction (m)	3.5	-19	-19	-19	-19	-19	-19	-19	-19	
Screening (δ = /m)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R1	Lp @ R1	49	32	16	7	1	-4	-9	-16	24
R2										
Directivity correction	(4770,0deg x 1500,60deg)	3	2	3	2	2	2	2	2	
Distance correction (m)	22	-35	-35	-35	-35	-35	-35	-35	-35	
Screening (δ = /m)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R2	Lp @ R2	41	23	10	-1	-7	-12	-16	-23	15

Discharge										
Condenser Discharge										
Sound power	Lw	74	69	62	64	70	66	58	49	72
End reflection	3.09	-1	0	0	0	0	0	0	0	
SRI of opening	1.L	-13	-26	-40	-45	-45	-45	-45	-45	
Lw of opening		60	43	22	19	25	21	13	4	35
R1										
Directivity correction	(2060,90deg x 1500,0deg)	0	0	-4	-7	-7	-7	-7	-7	
Distance correction (m)	2.5	-16	-16	-16	-16	-16	-16	-16	-16	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R1	Lp @ R1	47	30	5	-1	5	1	-7	-16	22
R2										
Directivity correction	(2060,0deg x 1500,60deg)	2	2	2	2	2	2	2	2	
Distance correction (m)	22	-35	-35	-35	-35	-35	-35	-35	-35	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R2	Lp @ R2	30	13	-8	-11	-5	-9	-17	-26	5

VRV Unit Discharge										
Sound power	Lw	87	85	85	82	76	72	67	62	83
End reflection	3.315	-3	-1	0	0	0	0	0	0	
SRI of opening	1.L	-13	-26	-40	-45	-45	-45	-45	-45	
Lw of opening		71	58	45	37	31	27	22	17	47
R1										
Directivity correction	(2210,90deg x 1500,0deg)	0	0	-4	-7	-7	-7	-7	-7	
Distance correction (m)	2.5	-16	-16	-16	-16	-16	-16	-16	-16	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R1	Lp @ R1	58	45	28	17	11	7	2	-3	34
R2										
Directivity correction	(2210,0deg x 1500,60deg)	2	2	2	2	2	2	2	2	
Distance correction (m)	22	-35	-35	-35	-35	-35	-35	-35	-35	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R2	Lp @ R2	41	27	15	7	1	-4	-8	-13	17

SUMMARY

Receptor R1

Intake
Condenser Discharge
VRV Discharge
Cumulative

63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
49	32	16	7	1	-4	-9	-16	24
47	30	5	-1	5	1	-7	-16	22
58	45	28	17	11	7	2	-3	34
59	45	28	17	12	8	3	-3	35

Receptor R2

Intake
Condenser Discharge
VRV Discharge
Cumulative

41	23	10	-1	-7	-12	-16	-23	15
30	13	-8	-11	-5	-9	-17	-26	5
41	27	15	7	1	-4	-8	-13	17
44	29	16	7	2	-2	-7	-13	19

F.2 Night-time

Description	Notes	Sound level (dB) at octave band centre frequency								LAeq (dB)
		63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
Plant room										
Intake										
Reverberant level in plant room	Rev Lp	79	73	75	69	64	60	55	47	71
All plant running										
Opening area (m2)	7.2	9	9	9	9	9	9	9	9	
SRI of opening	IL	-13	-26	-40	-45	-45	-45	-45	-45	
Inside-outside correction		-6	-6	-6	-6	-6	-6	-6	-6	
Lw of opening	Lw	68	49	37	26	22	17	13	5	43
R1										
Directivity correction	(4770,90deg x 1500,0deg)	-5	-5	-8	-7	-7	-7	-7	-7	
Distance correction (m)	3.5	-19	-19	-19	-19	-19	-19	-19	-19	
Screening (δ = /m)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R1	Lp @ R1	47	29	14	3	-1	-6	-10	-18	22
R2										
Directivity correction	(4770,0deg x 1500,60deg)	3	2	3	2	2	2	2	2	
Distance correction (m)	22.0	-35	-35	-35	-35	-35	-35	-35	-35	
Screening (δ = /m)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R2	Lp @ R2	39	19	8	-4	-9	-13	-18	-26	13

Discharge										
Condenser Discharge										
Sound power	Lw	74	69	62	64	70	66	58	49	72
End reflection	3.1	-1	0	0	0	0	0	0	0	
SRI of opening	1.L	-13	-26	-40	-45	-45	-45	-45	-45	
Lw of opening		60	43	22	19	25	21	13	4	35
R1										
Directivity correction	(2060,90deg x 1500,0deg)	0	0	-4	-7	-7	-7	-7	-7	
Distance correction (m)	2.5	-16	-16	-16	-16	-16	-16	-16	-16	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R1	Lp @ R1	47	30	5	-1	5	1	-7	-16	22
R2										
Directivity correction	(2060,0deg x 1500,60deg)	2	2	2	2	2	2	2	2	
Distance correction (m)	22.0	-35	-35	-35	-35	-35	-35	-35	-35	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R2	Lp @ R2	30	13	-8	-11	-5	-9	-17	-26	5

SUMMARY

Receptor R1

Intake

Condenser Discharge

Cumulative

63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
47	29	14	3	-1	-6	-10	-18	22
47	30	5	-1	5	1	-7	-16	22
50	33	14	5	6	2	-5	-14	25

Receptor R2

Intake

Condenser Discharge

Cumulative

39	19	8	-4	-9	-13	-18	-26	13
30	13	-8	-11	-5	-9	-17	-26	5
39	20	8	-3	-4	-8	-14	-23	14

Appendix G Plantroom Layout

