

Sainsbury's
Leigh Rd
Eastleigh
SO50 9FH

Plant Noise Impact Assessment

On behalf of

RAC
ENGINEERING
SERVICES LTD

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	Name	Qualifications	Initials	Date
Prepared by:	Nigel Chandler	BSc(Hons), MIOA	NAC	7 th May 2024
Reviewed and approved by:	Jon Stump	Bsc(Hons), MIOA	JS	7 th May 2024
For and on behalf of Noise Solutions Ltd				

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Reg no. 3483481 Trading office 5 Oriel Court, Omega Park, Alton GU34 2YT

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Executive Summary

Noise Solutions Limited has been appointed to provide a noise impact assessment of replacement plant to be installed for the existing Sainsbury's store in Eastleigh.

The new plant will be located on the roof of the building toward the south east corner.

Plant noise levels have been predicted at the nearest noise-sensitive receptors and assessed against the local authority's usual criteria. Predicted noise levels will meet the proposed criteria and should therefore be acceptable.

1.0 Introduction

- 1.1. Noise Solutions Ltd (NSL) has been commissioned to provide a noise impact assessment of replacement plant serving the existing Sainsbury's store at Eastleigh.
- 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 receptors and assessed against the local authority's usual requirements.
- 1.4. A glossary of acoustic terminology is given in [Appendix A](#).

2.0 Details of development proposals

- 2.1. The existing store is sited on Leigh Road in Eastleigh. It is proposed to replace the existing external refrigeration plant.
- 2.2. The replacement plant is to be located on the roof toward the south east corner of the building and will comprise a gas cooler and three Air Source Heat Pumps (ASHPs). Two refrigeration packs will be installed within an internal plantroom adjacent to the gas cooler.
- 2.3. The refrigeration plant will operate at all times but may run at reduced duty at night when the store is closed, and cooling demands are lower. The ASHPs may also run at any time, but do not typically operate at night.
- 2.4. An aerial view showing the plant and receptor locations, is given in [Appendix B](#). The proposed plant layout is shown in [Appendix D](#), with plant noise data shown in [Appendix E](#).

3.0 Nearest noise sensitive receptors

- 3.1. The store is located in a predominantly commercial area, with residential flats above shops to the south.
- 3.2. The nearest residential property to the plant is located at 15 Leigh Road, directly southeast of the plant area (Receptor R1). The closest windows are approximately 35m from the closest plant but screened from it by the plantroom building envelope at the south east corner of the roof.
- 3.3. The nearest offices are to the south east across Upper Market Street, approximately 25m from the plant.

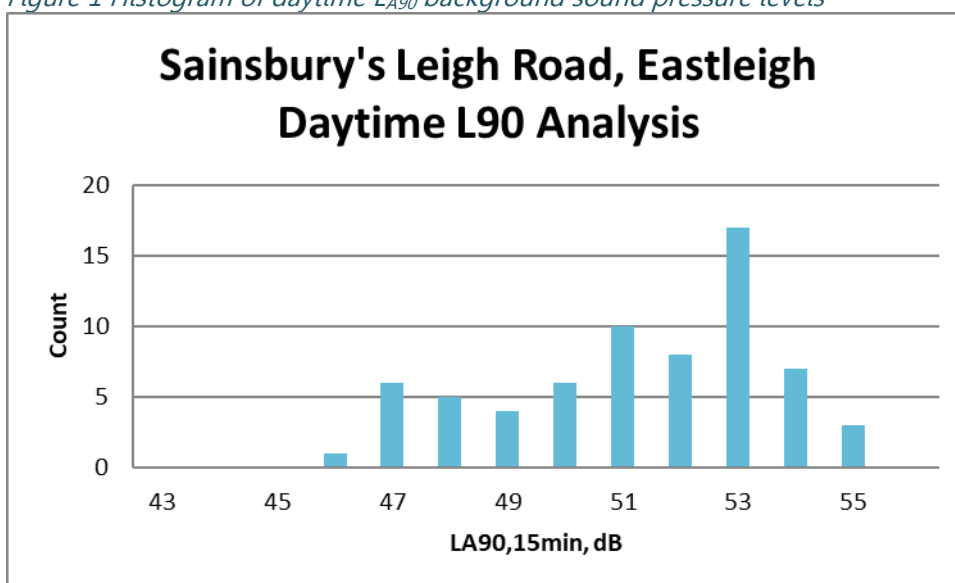
4.0 Existing noise climate

- 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 _{Amax} (15mins)	L _{A10} (15mins)	L _{A90} (15mins)
Daytime (07.00 – 23.00 hours)	55-70	72-97	54-71	46-55
Night-time (23.00 – 07.00 hours)	45-70	47-93	46-72	44-48

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

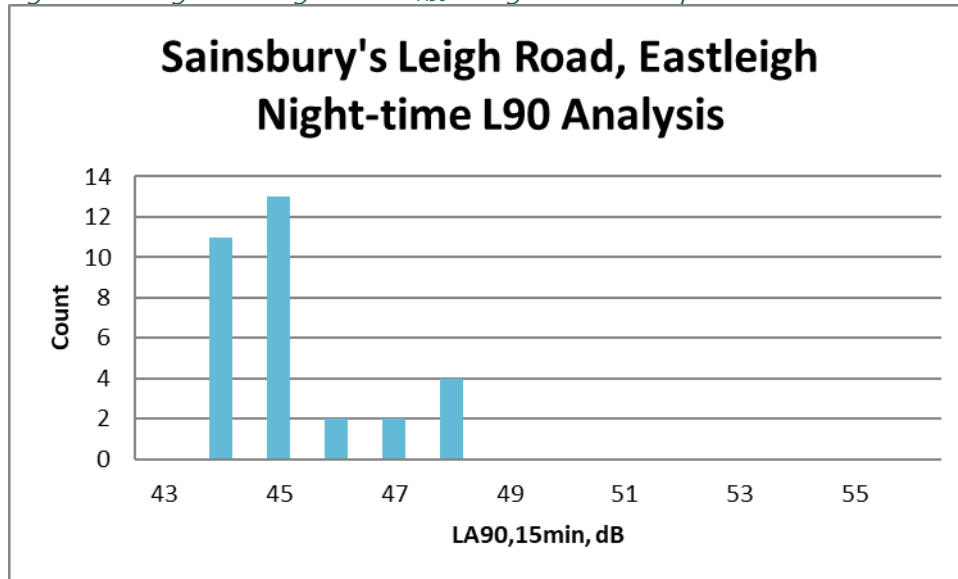


- 4.3. Additional statistical analysis has been undertaken. As shown in Table 2, the mean, median, and modal values have been calculated:

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

dB, L _{A90} daytime period	
Mean	51
Mode	53
Median	52

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	45
Mode	45
Median	45

- 4.5. Based on the histogram analyses above, the following values have been considered as representative of the existing background sound pressure levels at nearby noise sensitive premises:
- 47dB L_{A90} during the daytime period; and
 - 45dB L_{A90} during the night-time period.
- 4.6. The above values have been selected to be representative of periods when 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

Eastleigh Borough Council

- 5.1. Eastleigh Borough Council has previously been contacted¹ in order to establish their current requirements for the assessment of noise from fixed plant. Stuart Wedgbury² returned the initial enquiry and stated that generally the Council would prefer plant noise emissions to be controlled to a level at least 5dB below the representative background noise level when assessed in accordance with BS 4142:2014. However, it was also confirmed that a criterion not exceeding the background noise level may be considered acceptable provided context is suitably addressed.

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+A1:2019 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."

¹ Telephone call 27 February 2020

² Environmental Health Consultant telephone call 13 March 2020

- 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.

Commercial premises

- 5.12. Typically, local authorities do not consider non-residential premises to be as sensitive to noise as residential properties and, therefore, emissions criteria are generally relaxed at these locations.

5.13. However, it is considered appropriate to control plant noise levels within offices to meet the recommended internal noise levels provided in BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'. The standard states a range of noise levels for private offices of 35-40dB L_{Aeq} .

5.14. In addition, BS 8233 provides general guidance on the expected sound insulation performance of a given building façade, with details of how various elements can affect the overall performance. Concerning windows, it states that:

If partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15dB.

5.15. This implies that should windows on a noise affected façade be openable, a sound insulation value of 15dB should be applied to the whole façade to an internal room being assessed. It should be noted that a sound insulation performance of much greater than 15dB is expected for non-openable standard double-glazed windows. However, in order to assess the worst-case scenario, this report assumes that windows may be opened if desired.

5.16. The guidance is based on the control of traffic noise and it is usually considered appropriate to reduce the limits by 5dBA where the source is less anonymous. The worst-case internal criterion is therefore proposed to be 30dB L_{Aeq} due to plant noise.

5.17. Based on the above and assuming a 15dB reduction through a partially-opened window, cumulative plant noise levels at the office windows should not exceed 45dB L_{Aeq} .

Summary of requirements

5.18. In order to meet the local authority's emissions criterion, the cumulative plant noise rating level of the proposed plant would need to be controlled to a level at least 5dB below the representative L_{A90} background sound level at the nearest residential property. In addition it is proposed to limit the plant specific noise level to no higher than 45dBA at the nearest office windows. Proposed noise limits are therefore as shown in Table 4.

Table 4 Proposed plant noise limits

Receptor	Period	Cumulative plant rating level, dB $L_{Ar,Tr}$
R1 (Residential)	Daytime (07.00 – 23.00 hours)	42 dB $L_{Ar,Tr}$
	Night-time (23.00 – 07.00 hours)	40 dB $L_{Ar,Tr}$
R2 (Offices)	Daytime (07.00 – 23.00 hours)	45 dB L_{Aeq}

- 5.19. These limits will result in a plant noise rating level at or below that at which a "low impact" would be expected, according to the method described in BS 4142:2014.

6.0 Plant noise assessment

- 6.1. Plant noise levels at the most affected noise sensitive receptors have been predicted based on the manufacturer's noise data for the proposed equipment. The assessment has taken account of the distance between the plant and the nearest receptors, orientations, screening (from the building envelope, as appropriate), reflections and other propagation effects.
- 6.2. 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. 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...".
- 6.3. Table 5 summarises the results of the assessment outside the nearest noise-sensitive dwellings. 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 calculations are presented in [Appendix F](#).

Table 5 Plant noise assessment

Receptor	Period	Predicted plant rating level at receptor, $L_{Ar,Tr}$ (dB)	Proposed design criterion (dB $L_{Ar,Tr}$)	Difference (dB)
R1	Daytime (07.00 – 23.00 hours)	31	42	-11
	Night-time (23.00 – 07.00 hours)	31	40	-9
R2	Daytime (07.00 – 23.00 hours)	41*	45*	-4

**Specific sound pressure level, dB L_{Aeq}*

- 6.4. The above assessment demonstrates that noise from the proposed plant will comply with the local authority's usual requirements.

Assessment of uncertainties

- 6.5. Where possible uncertainty in this assessment has been minimised by taking the following steps:
- The measurement of the background sound levels was undertaken over a period including the quietest times of the day and night.
 - The sound level meter and calibrator used have a traceable laboratory calibration and the meter was field calibrated before and after the measurements.
 - Uncertainty in the calculated impact 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 at a position where higher noise levels are present.

7.0 Summary

- 7.1. Noise Solutions Ltd (NSL) has been commissioned to provide a noise impact assessment of replacement plant serving the existing Sainsbury's store in Eastleigh.
- 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 proposed plant area.
- 7.3. Plant noise levels have been predicted at the nearest noise-sensitive receptor and assessed against the local authority's usual requirements. The assessment shows that plant noise levels will meet the proposed criteria and should therefore be acceptable to the local authority.

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 environmental sound survey

- C.1 Measurements of the existing background sound levels were undertaken between 10.45 hours on Thursday 10th August and 11.30 hours on Friday 11th August 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 fifteen-minute sample periods for the duration of the survey.

Measurement position

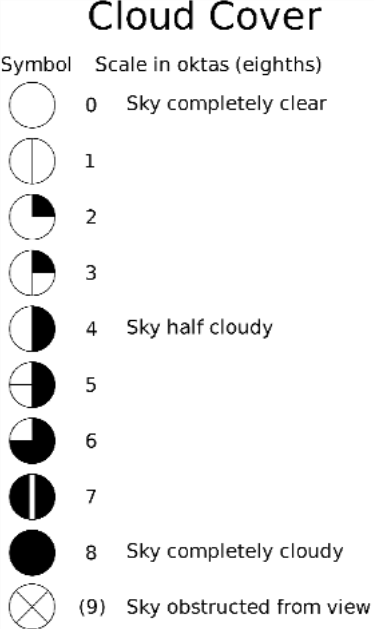
- C.3 The representative measurement position was located on a lamp post on High Street (location indicated on the site plan in Appendix B). This location is approximately representative of the levels of road traffic noise at the closest elevation of the building.
- C.4 The approximate location of the 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.

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.

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 977/ 69747	01/08/2022	1503080-1
Condenser microphone	ACO Pacific 7052E / 70829		
Preamplifier	Svantek SV12L / 73687		
Calibrator	Svantek SV30A / 10843	02/11/2022	1503080-2

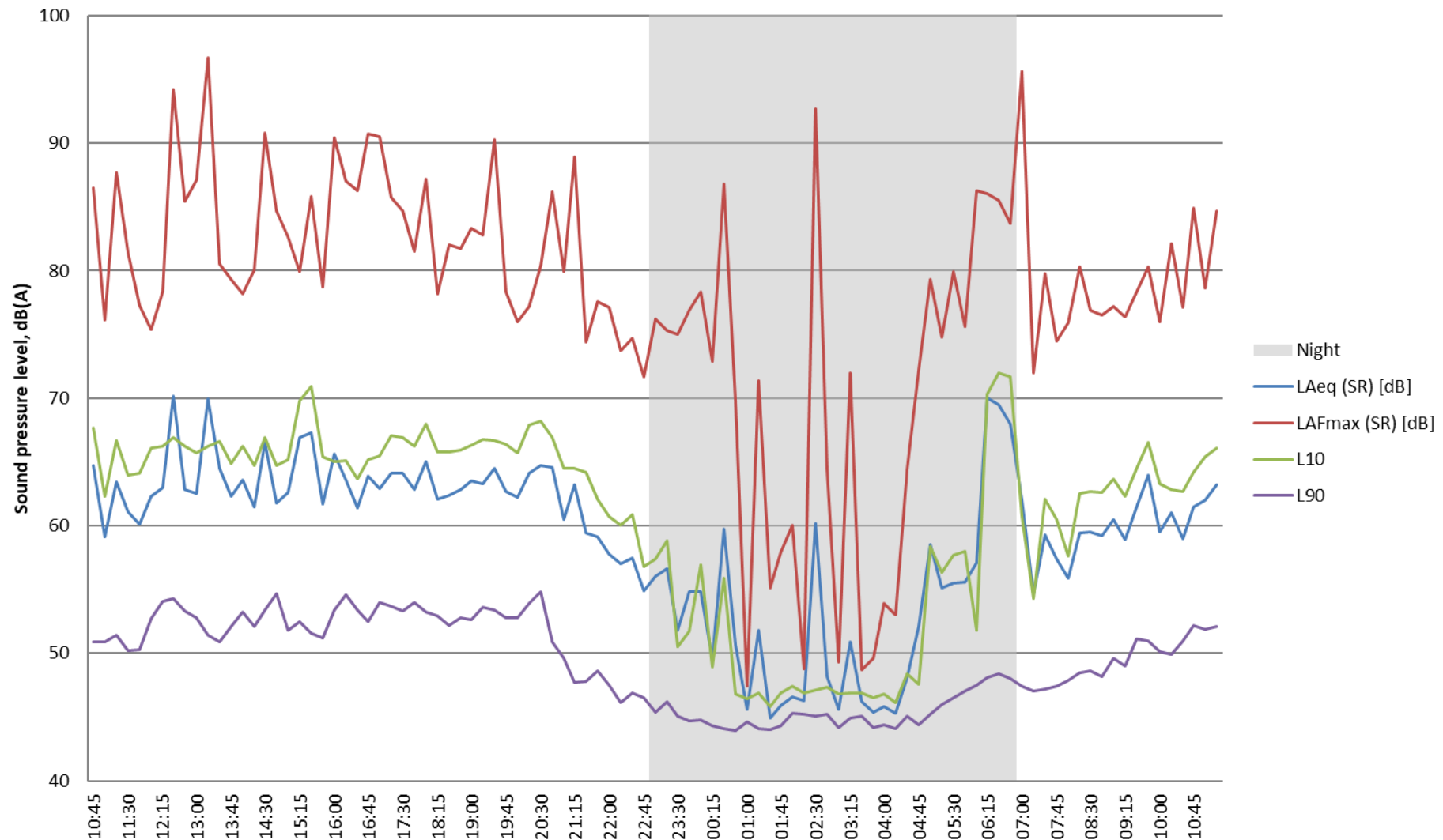
- C.6 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were appropriate for environmental noise measurements. The table below presents the weather conditions recorded on site at the beginning and end of the survey.

Weather Conditions				
Measurement Location	Time/Date	Description	Beginning of Survey	End of Survey
As indicated on Appendix B	10.45 10 Aug - 11.30 11 Aug 2023	Temperature (°C)	22	19
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)	2	4
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	No	Damp
		Wind Speed (m/s)	<1	<1
		Wind Direction	S	SE
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	n/a	n/a

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 to the plant area during the quietest times at which the plant will operate. The noise climate at the measurement position was dominated by local road and air traffic, along with distant road traffic. The results of the survey are presented in a time history graph overleaf.

Sainsbury's Leigh Road, Eastleigh Thursday 10 - Friday 11 Aug 2023



[illegible]

Appendix E Plant noise data

Plant	Unit/Model	No. of units	Sound Level Daytime	Sound Level Night-time
Gas Cooler 311.1/ 312.1	Kelvion GF-PD203G4H-091R	1	38dBA at 10m	38dBA at 10m
Air Source Heat Pumps	Clade ACER LN 130/100 ASHP	3	42 ± 2dBA at 10m, each	42 ± 2dBA at 10m, each

Plant	Plant noise level at source		Distance		Directivity	Screening	BS4142 Feature	Rating Level at Receptor (dB)
	Noise level (dBA)	Distance (m)	m	Correction (dB)	Correction (dB)	Correction (dB)	Correction (dB)	
Gas Cooler 311.1/312.1	38	10	35	-11	0	-8	3	22
ASHP1	44	10	43	-13	0	-8	3	26
ASHP2	44	10	45	-13	0	-8	3	26
ASHP3	44	10	47	-13	0	-8	3	26
Combined sound rating level at receptor, day and night								31

Receptor R2

Plant	Plant noise level at source		Distance		Directivity	Screening	BS4142 Feature	Sound Pressure Level at Receptor (dB)
	Noise level (dBA)	Distance (m)	m	Correction (dB)	Correction (dB)	Correction (dB)	Correction (dB)	
Gas Cooler 311.1/312.1	38	10	25	-8	0	0	n/a	30
ASHP1	44	10	25	-8	0	0	n/a	36
ASHP2	44	10	25	-8	0	0	n/a	36
ASHP3	44	10	25	-8	0	0	n/a	36
Combined sound pressure level at receptor, day and night								41