

The Co-operative store

124 Henley Road
Caversham
Reading
RG4 6DH

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 undertake a noise impact assessment for replacement plant to be installed for the existing Co-operative store at Henley Road in Caversham, Reading.

The assessment shows that noise from the proposed additional plant will comply with the local authority's usual requirements, inclusive of an acoustic barrier to the AC units, and should therefore be acceptable.

1.0 Introduction

- 1.1. Noise Solutions Ltd (NSL) has been commissioned to provide a noise impact assessment for replacement plant serving the existing Co-operative store at Henley Road in Caversham, Reading.
- 1.2. This report contains recommendations based on project information available at the time of the assessment. NSL can provide further guidance on receipt of the selected plant details.
- 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 Co-operative store is situated on the end of a parade of shops on the north side of Henley Road, adjacent to its junction with Chiltern Road. The site location is shown in [Appendix B](#).
- 2.2. Replacement plant is to be installed, replacing the existing plant within a service area at the rear (north) of the store.
- 2.3. Plant is to comprise two air conditioning (AC) units and a refrigeration pack and an associated gas cooler. The AC units will operate only during the daytime; 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.
- 2.4. An acoustic barrier, comprising either solid timber or bespoke acoustic panels, is proposed to the south of the AC units.
- 2.5. The proposed plant location is shown in [Appendix D](#); manufacturer noise data for the equipment is given in [Appendix E](#).

3.0 Nearest noise sensitive receptors

- 3.1. The nearest residential properties to the plant are the first floor flats above the parade of shops. Although these are set back from the rear elevation of the store, the nearest property (Receptor R1) may have line of sight of the plant items at a distance of around 14m. As a robust assessment it is assumed that no screening is provided to the refrigeration equipment, although the proposed barrier will prevent line of sight of the AC units.

- 3.2. A house on Tilbury Close (Receptor R2) will be around 25m from the plant. Although some screening may be provided by intervening sheds or garages, as a robust assessment it is assumed that no screening is provided to any plant.

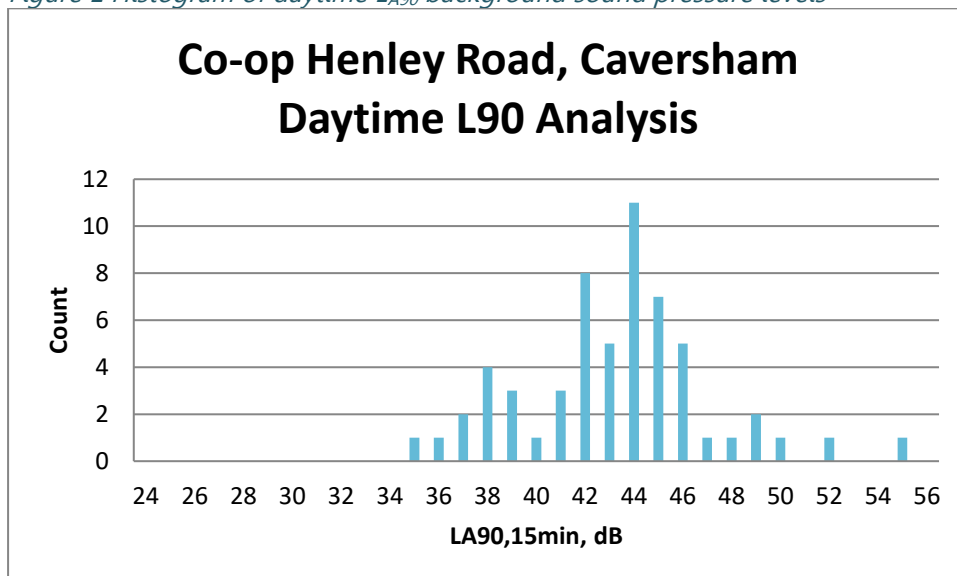
4.0 Existing noise climate

- 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. 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)	46-65	66-88	50-73	35-55
Night-time (23.00 – 07.00 hours)	27-55	39-79	29-58	24-40

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

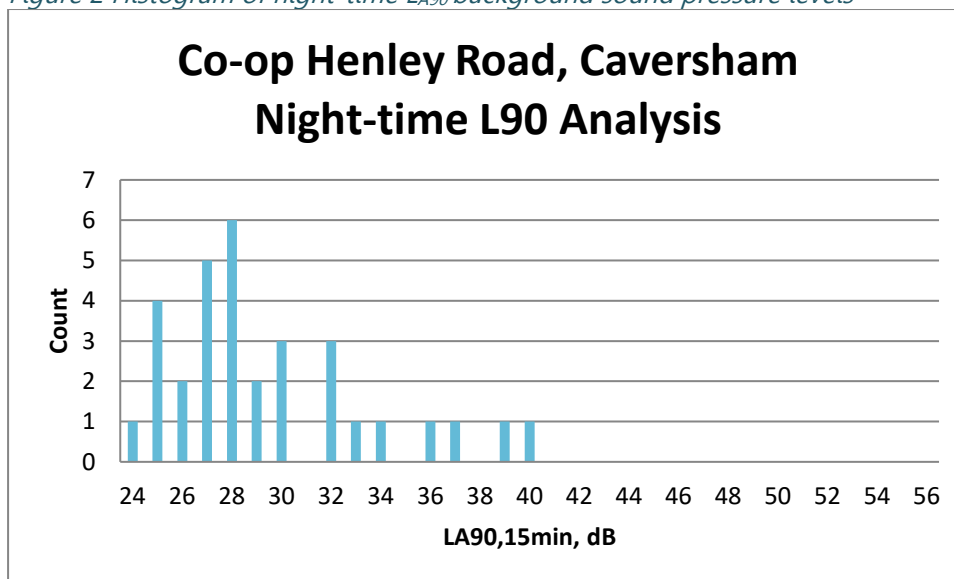


- 4.3. Additional statistical analysis has been undertaken. As shown in Table 2, the mean, median, and modal values have been calculated:

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

dB, L_{A90} daytime period	
Mean	43
Mode	44
Median	44

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	29
Mode	28
Median	28

- 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:

- 40dB L_{A90} during the daytime period; and
- 25dB 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+A1:2019.

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

- 5.3. 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"*.
- 5.4. 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.
- 5.5. The specific sound level is converted to a rating level by adding penalties on a sliding scale to account for either potentially tonal or impulsive elements. The standard sets out objective methods for determining the presence of tones or impulsive elements, but notes that it is acceptable to subjectively determine these effects.

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

- 5.6. The penalty for tonal elements is between 0dB and 6dB, and the standard notes: *"Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible."*
- 5.7. The penalty for impulsive elements is between 0dB and 9dB, and the standard notes: *"Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."*
- 5.8. The 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.*
- 5.9. 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."*
- 5.10. The standard goes on to note that: *"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."*
- 5.11. In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014 edition places emphasis upon an appreciation of the context, as follows:
- "An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context."*

- 5.12. BS 4142:2014 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.

Low background sound levels

- 5.13. 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

- 5.14. In accordance with Reading Borough Council's usual requirements, it is proposed that the rating level of the new plant is at least 10dBA below the pre-existing representative background sound level.
- 5.15. 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 30dBA outside the nearest residential windows at night.
- 5.16. The cumulative noise level for the proposed plant at the nearest residential windows should not therefore exceed the limits shown in Table 4.

Table 4 Proposed plant noise emissions level limits at noise sensitive residential receptors

Period	Cumulative plant rating noise level, dB L _{Ar,Tr}
Daytime (07.00 – 23.00 hours)	30
Night-time (23.00 – 07.00 hours)	30

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

6.0 Plant noise impact assessment

- 6.1. Plant noise levels at the nearest noise sensitive receptors have been predicted based on manufacturer's noise data for the existing and proposed equipment. The assessment has taken into consideration distance attenuation and directivity.
- 6.2. An acoustic barrier, of either solid timber or bespoke acoustic panels, is proposed around the AC units to prevent line of sight from receptor R1.
- 6.3. The proposed plant is not anticipated to exhibit any tonal or impulsive characteristics provided it is well maintained. All proposed external plant will be inverter driven and, therefore, will gently ramp up and down depending on the demands on the various systems. To provide a robust assessment, a 3dB acoustic feature correction as described in BS 4142:2014+A1:2019 for the possible presence of "*...characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment...*" has been applied to the night-time levels. During the daytime period, when the plant is to be 10dB below the background noise level and will be close to inaudible, no feature correction has been applied.
- 6.4. Table 5 summarises the results of the assessment at the most affected properties. All other nearby receptors benefit from increased distance and / or screening to the plant such that resulting noise levels will be lower than at the receptors considered. The full set of calculations can be found in [Appendix F](#).

Table 5 Plant noise levels at receptors

Receptor	Period	Predicted rating level at receptor, $L_{Ar,Tr}$ (dB)	Criterion (dB $L_{Ar,Tr}$)	Difference, dBA
R1 (Residential)	Daytime (07.00 – 23.00 hours)	30	30	0
	Night-time (23.00 – 07.00 hours)	23	30	-7
R2 (Residential)	Daytime (07.00 – 23.00 hours)	29	30	-1
	Night-time (23.00 – 07.00 hours)	19	30	-11

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 for replacement plant serving the existing Co-operative store at Henley Road, Caversham, Reading.
- 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. Plant noise levels have been predicted at the nearest noise-sensitive receptors. The assessment shows that noise from the proposed plant, when attenuated as described in this report, will comply with the local authority's usual requirements and other recognised guidance and should therefore be acceptable.

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 environmental sound levels were undertaken between 16.19 hours on Monday 14th October and 14.49 hours on Tuesday 15th October 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 fifteen-minute sample periods for the duration of the survey.

Measurement position

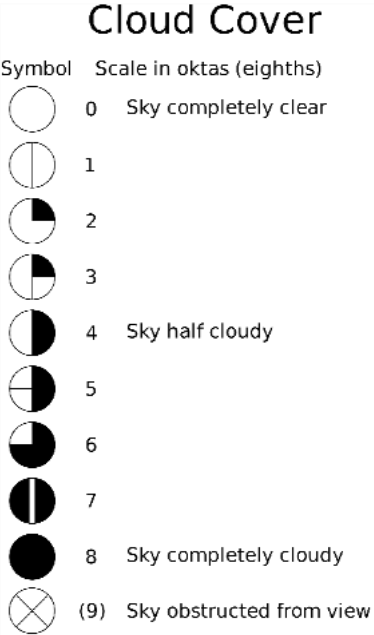
- C.3 The sound level meter was positioned on a lamppost along Rossendale Road. The approximate location of the microphone is indicated on the aerial photograph in [Appendix B](#). In accordance with BS 7445-2:1991 '*Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use*', the measurements were undertaken under free-field conditions.
- C.4 The survey location was chosen such that the lowest background noise levels were similar to those at the nearest residential receptors but exclude any potential effect of noise from existing plant serving the store.

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	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

- 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	16.19 14/10/24 - 14.49 15/10/24	Temperature (°C)	16	20
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	7
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	Yes	No
		Wind Speed (m/s)	2	2
		Wind Direction	S	S
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

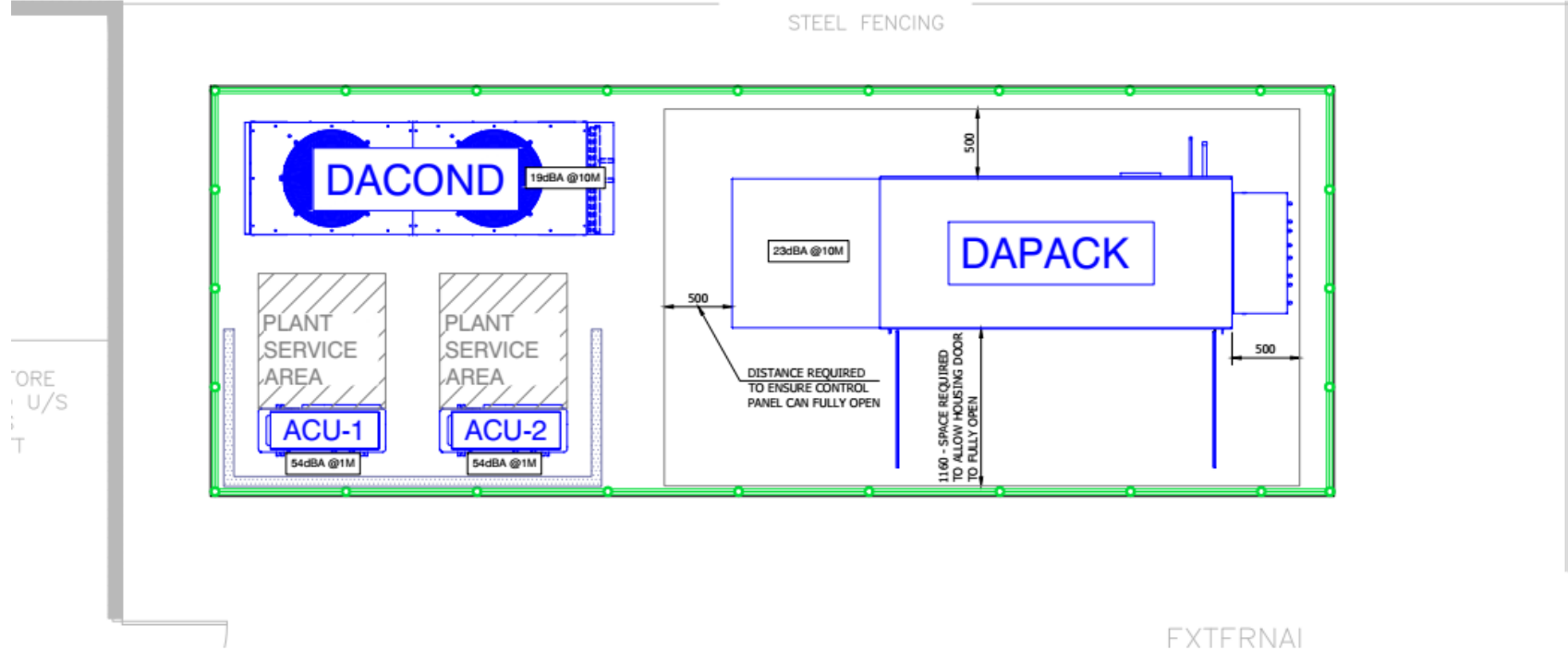
Results

- C.7 The results of the survey are considered to be representative of the background sound pressure levels at the façades of the most affected noise sensitive receptors to the plant area during the quietest times at which the plant will operate. The noise climate at the measurement position was observed to be due to local and distant traffic. The results of the survey are presented in a time history graph overleaf.

Co-op Henley Road, Caversham Monday 14 - Tuesday 15 Oct 2024



Appendix D Proposed plant layout



Appendix E Manufacturer plant noise data

Plant Item	Make/Model	Quantity	Operating period	Sound pressure level (dBA)
Condenser	-	1	24hr	19dBA at 10m
Pack	-	1	24hr	23dBA at 10m
ACs	-	2	Daytime only	54dBA at 1m (each)

Appendix F Calculations

Receptor R1 - Daytime

Plant	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	19	10	17	-5	0	0	0	14
Gas cooler	23	10	17	-5	0	0	0	18
AC1	54	1	14	-23	0	-5	0	26
AC2	54	1	14	-23	0	-5	0	26
							Cumulative	30

Receptor R1 – Night-time

Plant	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	19	10	17	-5	0	0	3	17
Gas cooler	23	10	17	-5	0	0	3	21
AC1	-	1	14	-23	0	-5	3	-
AC2	-	1	14	-23	0	-5	3	-
							Cumulative	23

Receptor R2 - Daytime

Plant	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	19	10	25	-8	0	0	0	11
Gas cooler	23	10	26	-8	0	0	0	15
AC1	54	1	26	-28	0	0	0	26
AC2	54	1	28	-29	0	0	0	25
							Cumulative	29

Receptor R2 – Night-time

Plant	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	19	10	25	-8	0	0	3	14
Gas cooler	23	10	26	-8	0	0	3	18
AC1	-	1	26	-28	0	0	3	-
AC2	-	1	28	-29	0	0	3	-
							Cumulative	19