NSL
Noise Solutions Ltd

The Co-operative

33 Chichester Road
Bognor Regis
PO21 2XH

Plant Noise
Design Guidance

On behalf of

RPM

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[redacted]

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Executive Summary

Noise Solutions Limited has carried out a noise survey in Bognor Regis to set noise limits for new refrigeration plant to be installed at a proposed Co-operative store located at 33 Chichester Road.

It is understood that refrigeration and air conditioning plant will be installed externally in a plant area on the south western side of the building.

Based on the information contained within this report, the following plant noise emission limits apply:

Guidance on maximum refrigeration plant noise emission limits

Plant	Period	Maximum plant noise emission level (L_{Aeq})
Refrigeration plant	Daytime (07.00 – 23.00 hours)	38dB at 10m
	Night-time (23.00 – 07.00 hours)	23dB at 10m
Air conditioning plant (total)	Daytime (07.00 – 23.00 hours)	56dB at 1m

NSL should be consulted once the final layout/selections have been confirmed.

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1.0 Introduction

1.1. Noise Solutions Ltd (NSL) has been commissioned by RPM to provide guidance on the maximum noise emissions for plant serving a proposed Co-operative store located at 33 Chichester Road in Bognor Regis.

1.2. This report contains recommendations based on project information available at the time of the assessment and the results of a baseline noise survey. NSL can provide further guidance on receipt of the selected plant details.

1.3. 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 building is currently occupied by another convenience store. It is understood that the new Co-op unit will occupy the ground floor of the building.

2.2. It is proposed to locate the refrigeration and air conditioning plant in an external plant area at the rear, south western side of the store.

3.0 Nearest noise sensitive receptors

3.1. The area surrounding the site is predominantly residential in nature. The nearest noise sensitive property to the plant location are the flats located above the store, approximately 5m from the proposed plant area.

3.2. A site plan showing the site and surrounding area, the nearest noise sensitive properties and noise monitoring location used in this assessment is 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.

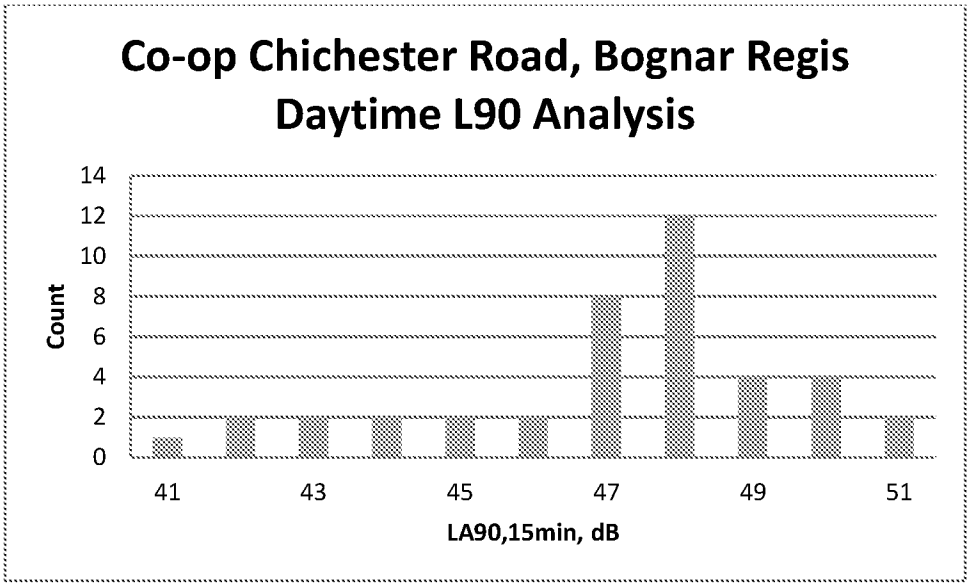
4.2. The results of the environmental sound survey are summarised in Table 1 below. The full set of measurement results and details of the survey methodology are presented in Appendix C.

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Table 1 Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	$L_{A90,1hr}$	$L_{Amax,fast}$	$L_{Aeq,1hr}$	$L_{Aeq,5mins}$
Daytime (07.00 – 23.00 hours)	50-60	67-83	54-61	41-51
Night-time (23.00 – 07.00 hours)	38-54	57-74	38-56	29-46

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.

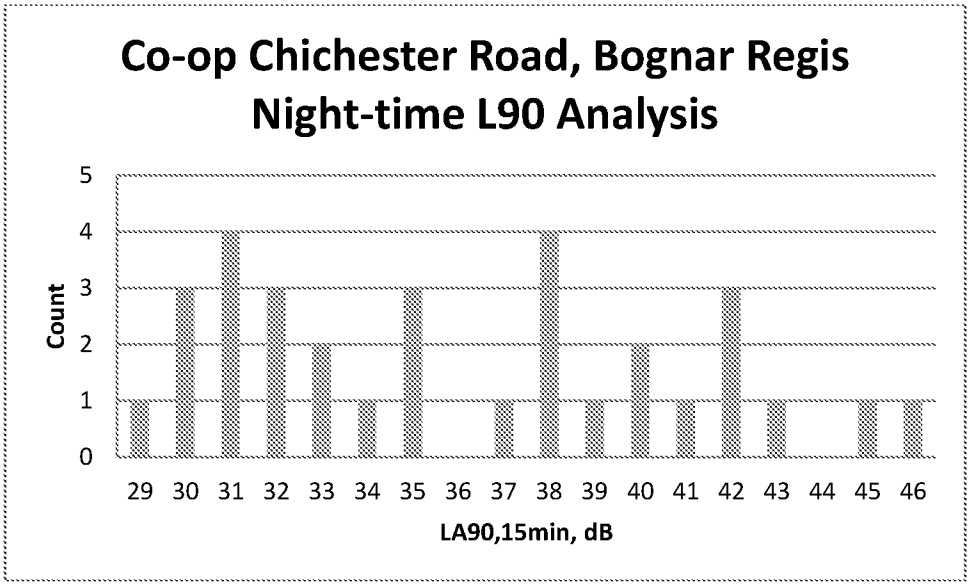
Table 2 Statistical analysis of $L_{A90,15min}$ levels during the daytime period

dB L_{A90} daytime period	
mean	47
modal	48
median	48

4.4. 47dB has been selected to be representative of the background noise climate in this area.

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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	36
modal	35
median	38

4.6. In order to be robust, 30dB(A) 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:

- 47dB L_{A90} during the daytime period; and
- 30dB L_{A90} during the night-time period

5.0 Plant noise design criteria

Planning Noise Advice Document: Sussex 2015

5.1. The Planning Noise Advice Document for Sussex contains the following paragraph in relation to Industrial and Commercial Noise Sources.

> *"The starting point for designing any industrial/ commercial development should be to minimise noise "as far as reasonably practicable". The rating level of the plant/process, when*

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measured in accordance with BS4142:2014, should, where practicable, be no greater than the existing background levels when measured in accordance with BS4142:2014. There may be instances, for specific sites, where a rating level below background is deemed appropriate. This can be determined through prior discussion with the Local Planning Authority or Local Environmental Health Department. For example, a rating level of 10 dBA below background may be required in certain instances if there are specific concerns such as the potential for noise creep. It is considered that meeting these criteria would avoid adverse noise impacts, in the interests of ensuring a good standard of amenity and protecting human health. Where these criteria are not attainable, the noise report should explain why, and how best practicable means will be implemented to control noise in order to satisfy the LPA that the development is acceptable"

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

5.2. BS 4142:2014 is intended to be used to assess the likely effects of sound on people residing in nearby dwellings. The scope of BS 4142:2014 includes *"sound from fixed plant installations which comprise mechanical and electrical plant and equipment"*.

5.3. The procedure contained in BS 4142:2014 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.*

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- *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 requires uncertainties in the assessment to be considered, and where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

Proposed criteria

5.12. In order that noise from new plant should have, at worst, a "low impact" according to the method in BS 4142:2014, the plant noise limits in Table 4 are proposed.

Table 4 Plant noise emissions limits at residences

Period	Cumulative plant noise rating level, dB(A)
Daytime (07.00 – 23.00 hours)	47
Night-time (23.00 – 07.00 hours)	30

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

6.0 AC and refrigeration plant noise limits

6.1. Cumulative noise levels from the proposed refrigeration plant should not exceed the following limits in order to demonstrate compliance with the criteria detailed in Section 5.22:

Table 5 Guidance on maximum refrigeration plant noise emission limits

Plant	Period	Maximum plant noise emission level (L_{Aeq})
Refrigeration plant	Daytime (07.00 – 23.00 hours)	38dB at 10m
	Night-time (23.00 – 07.00 hours)	23dB at 10m
Air conditioning plant (total)	Daytime (07.00 – 23.00 hours)	56dB at 1m

6.2. Where possible uncertainty in the above assessments has been minimised by taking the following steps:

- The meter and calibrator used have a traceable laboratory calibration and the meter was field calibrated before and after the measurements.
- Uncertainty in the calculated impacts has been reduced by the use of a well-established calculation method.
- Care was taken to ensure that the measurement positions were representative of the noise climate outside the nearby residential dwellings and not in positions where higher noise levels were present.

6.3. 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.

7.0 Summary

7.1. Noise Solutions Ltd has been commissioned by RPM to provide guidance on the maximum noise emissions for plant serving a proposed Co-operative store located at 33 Chichester Road, Bognor Regis.

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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. Guidance on the maximum noise emissions from the proposed plant has been provided. NSL should be consulted once the final layout/selections have been confirmed.

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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 (LAeq,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 s1 and s2 is given by 20 log10 (s1/s2). 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 20μPa. 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 Leq 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.

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Appendix B Aerial photograph site showing areas of interest



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Appendix C Environmental sound survey

Details of sound surveys

C.1 Measurements of the existing background sound levels were undertaken between 15.30 hours on Thursday 15th May and 10:15 hours on Friday 16th May 2019.

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 Hillsboro Road in an area representative of the nearest noise sensitive receptor (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

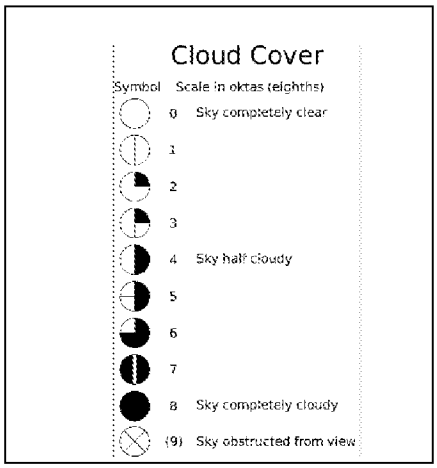
C.5 Details of the equipment used during the survey are provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (+/-0.2 dB) in the calibration level was noted.

Environmental noise survey

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Rion NL-52 / 00876023	02/04/2019	TCRT19/1237
Condenser microphone	Rion UC-59 /14826		
Preamplifier	Rion NH-25 / 87474		
Calibrator	Rion NC-74 /34535932	09/10/2017	1657

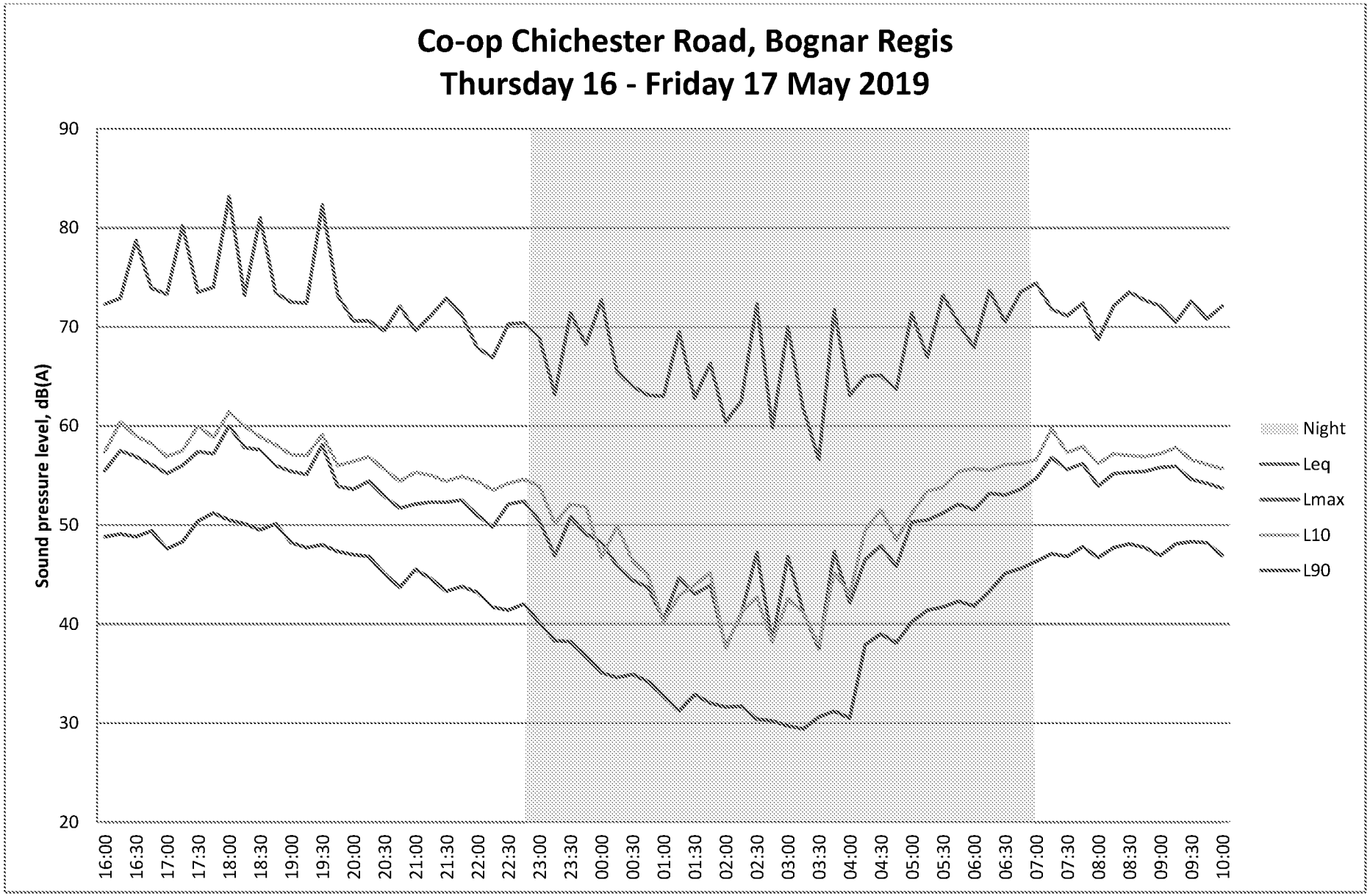
Weather Conditions

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	15:30 15/05/2019 – 10:15 16/05/2019	Temperature (°C)	18	13
		Precipitation:	No	No
		Cloud cover (oktas - see guide)	6	8
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	No	No
		Wind Speed (m/s)	1.5	1.5
		Wind Direction	North East	South East
		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 dominated by traffic noise. The results of the survey are presented in a time history graph overleaf.


Co-op Chichester Road, Bognar Regis
Thursday 16 - Friday 17 May 2019
Sound pressure level, dB(A)
90
80
70
60
50
40
30
20
16:00
16:30
17:00
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09:30
10:00
Night
Leq
Lmax
L10
L90