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**COOPERATIVE FOOD STORE
22-26 CRICKLEWOOD BROADWAY, LONDON
NOISE ASSESSMENT**

Technical Report: R6277-1 Rev 0

Date: 9th August 2016

For: The Co-operative Group Food Ltd
1 Angel Square
Manchester
M60 0AG

24 Acoustics Document Control Sheet

Project Title: Cooperative Food Store, 22-26 Cricklewood Broadway, London, Noise Assessment

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Document Status and Approval Schedule

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1.0 INTRODUCTION

- 1.1 24 Acoustics Ltd has been instructed by The Co-operative Food to undertake an assessment of noise from installed services plant at 22-26 Cricklewood Broadway.
- 1.2 This report presents the results of the assessment, following a site visit and background noise survey undertaken between 12th and 14th July 2016.
- 1.3 All noise levels in this report are presented in dB relative to 20 μ Pa.

2.0 SITE DESCRIPTION

- 2.1 The store is located in a mixed residential and commercial area in Camden, London. The store occupies the ground floor level only of 22-26 Cricklewood Broadway. The property is adjoined by commercial properties at ground floor level on Cricklewood Broadway.
- 2.2 The property was formerly used as a motor garage and was converted in 2015 to provide the present Cooperative food store. Air conditioning plant associated with the motor garage was installed and operating in the rear yard area which was removed prior to the conversion works.
- 2.3 The installed services plant at the site comprises several items including a bakery air extraction system, refrigeration (cooling to the cold room) and air conditioning to the store managers office. External plant comprises a Green & Cool refrigeration unit, a Daikin air conditioning condenser unit (model number RXS35L3V1B) and louvres for ventilation and bakery plant. All external plant operates only during store trading periods between 07:00 and 23:00 hours only with the exception of Green & Cool refrigeration unit. The Green & Cool refrigeration unit operates 24 hours a day on an on demand basis.
- 2.4 The nearest noise sensitive properties (and the most affected) are located above the shop at first floor level. The nearest noise sensitive properties are identified in Figure 2.
- 2.5 Retrospective planning consent for installation of the plant equipment was refused in May 2016 [Planning Reference: 2016/0398/P]. Reason 2 of the planning decision noted noise and vibration from operation of the plant was harmful to amenities of neighbouring residents and did not comply with the London Borough of Camden planning policy (DP28 relating to noise and vibration).

- 2.6 Remedial works have been undertaken since May 2016 to reduce noise emissions from the plant systems. Works have included installation of attenuators to bakery plant (between the bakery extract vent and atmosphere side louvre).
- 2.7 This report has assessed noise from the installed plant and determined suitable mitigation measures to achieve acceptable noise levels at the nearest affected properties in accordance with relevant standards and Local Planning Authority criteria.

3.0 CRITERIA

National Planning Policy Framework and Noise Policy Statement for England

- 3.1 The National Planning Policy Framework (NPPF) [Reference 1] states that planning policies and decisions should aim to:
- Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
 - Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions, while recognising that many developments will create some noise.
- 3.2 The NPPF also refers to the Noise Policy Statement for England (NPSE) [Reference 2] which is intended to apply to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise. The NPSE sets out the Government's long-term vision to 'promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development' which is supported by the following aims.
- Avoid significant adverse impacts on health and quality of life;
 - Mitigate and minimise adverse impacts on health and quality of life;

- 3.3 The NPSE defines the concept of a 'significant observed adverse effect level' (SOAEL) as 'the level above which significant adverse effects on health and quality of life occur'. The following guidance is provided within the NPSE:

"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."

- 3.4 The Planning Practice Guidance (PPG) [Reference 3] is written to support the NPPF with more specific planning guidance. The PPG reflects the NPSE and states that noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. It also states that opportunities should be taken, where practicable, to achieve improvements to the acoustic environment. The NPPG states that noise can over-ride other planning concerns but should not be considered in isolation from the other economic, social and environmental dimensions of the proposed development.
- 3.5 The PPG expands upon the concept of SOAEL (together with Lowest Observable Adverse Effect Level, LOAEL and No Observed Effect Level, NOEL) as introduced in the NPSE and provides a table of noise exposure hierarchy for use in noise impact assessments in the planning system.
- 3.6 The documents described above do not refer to specific noise criteria. When considering the impact of noise from new plant 24 Acoustics considers that the spirit of the requirements of the NPPF and NPSE will be complied with if criteria from British Standard 4142:2014 [Reference 4] are adopted.

BS 4142

- 3.7 BS 4142:2014 provides a method for rating the effects of industrial and commercial sound on residential areas.

- 3.8 The standard advocates a comparison between the representative measured L_{A90} background noise level and L_{Aeq} noise level from the source being considered. For rating purposes if the noise source is tonal, intermittent or otherwise distinctive in character, a rating correction should be applied.
- 3.9 The standard states that a difference between the rating level and the background level of around +10 dBA is an indication of a significant adverse impact, depending on the context and a difference of around +5 dBA is likely to be an indication of an adverse impact, also depending on the context. Where the rating level does not exceed the background noise level, this is an indication of the specific sound source having a low impact (depending upon the context).

Local Authority Requirements: London Borough of Camden

- 3.10 The London Borough of Camden planning guidance developmental policy 28 (DP28 Noise and Vibration) [Reference 5] states in Table E that noise from plant and machinery should be 5 dB or lower than the background noise level for daytime, evening and night-time periods.
- 3.11 For plant that contains an impulsive or tonal noise character, when assessed at the nearest sensitive property, the policy states that noise from plant and machinery should be at least 10 dB lower than the prevailing background noise level.

4.0 NOISE MEASUREMENTS

Background Noise Measurements

- 4.1 The following instrumentation was set up between 12th and 14th July 2016 to assess the background noise levels at a location representative of the nearest noise sensitive properties:

Svantek Type 1 precision sound level meter	Type 958
Brüel & Kjær acoustic calibrator	Type 4231

- 4.2 Measurements were undertaken at 2 m above local grade level at the rear of the store as shown in Figure 1. The prevailing source of background noise at the nearest noise sensitive properties is from road traffic. Other noise sources contributed to the measured background noise environment including; commercial activities (on Cricklewood Broadway and Rondu Road), nearby residential activities and aircraft movements.

- 4.3 The instrumentation was configured to record 5-minute measurements of the A-weighted statistical parameters including L_{Aeq} , L_{A90} and L_{Amax} (all measured on fast response). The survey was undertaken in general accordance with BS 7445: 1991 "Description and measurement of environmental noise Part 2 - Acquisition of data pertinent to land use [Reference 6]. Results have been averaged to determine hourly daytime and evening and 15 minute night-time sample periods as per guidance provided by BS 4142.
- 4.4 The calibration of all instrumentation was verified before and after the tests and no significant signal variation occurred. Calibration of 24 Acoustics' equipment is traceable to National Standards. The weather during the survey period was mostly fine and dry. Some short periods of rain occurred during the daytime on 12th July but it is not considered to have affected the measured background noise levels.
- 4.5 Due to the location of the background noise monitoring equipment, the background noise levels were partially influenced by the Green & Cool refrigeration plant. It was not possible, however, to measure at an alternative location due to access constraints of monitoring locations. The Green & Cool refrigeration plant operates on an on-demand basis and therefore the minimum background noise levels during the respective measurement periods are unaffected by plant operation.
- 4.6 However, to eliminate influence of plant in measurement results short term measurements of the Green & Cool refrigeration plant were undertaken, whilst operating under typical conditions during the daytime, and have been subtracted from the measured background noise level results, L_{A90} (unit operates on an on-demand basis, however, is assumed to operate continuously for purposes of the above correction).
- 4.7 Therefore, with respect to the above, background measurement results are considered to be representative of the existing background noise environment (prior to installation of the plant equipment) of the nearest residential properties at first floor level at the rear of 22-26 Cricklewood Broadway.
- 4.8 It is worth noting that measured background noise levels do not include influence of the motor garage or associated external plant which historically operated at the site prior to conversion of the premises to the present Cooperative Food Store. Background noise measurement results as described above are therefore considered to provide a worst case scenario where historic background noise levels could have been higher.

Results

- 4.9 The results of the corrected background noise measurements are presented in graphical format in Appendix B and shown below in Table 1. The typical background noise levels (L_{A90}) with respect to the site context is considered to be the minimum background noise levels for each relevant assessment period.

Date	Day Level, dB (07:00 - 23:00)	Evening Level, dB (23:00 - 07:00)	Night Level, dB (23:00 - 07:00)
	Minimum, $L_{A90, 1 \text{ hour}}$	Minimum, $L_{A90, 15 \text{ min}}$	Minimum $L_{A90, 15 \text{ min}}$
Tue 12/07/2016	46	44	38
Wed 13/07/2016	46	44	38
Thu 14/07/2016	45	-	-
Minimum Noise Level	45	44	38

Table 1: Background Noise Measurement Results – Corrected for Plant

Plant Noise Level Measurements

- 4.10 Noise measurements were undertaken of the plant items on 12th July 2016 during the daytime period when plant operating under normal conditions. Plant items were switched off for short periods in sequence to determine noise emissions from each unit. Measurements were undertaken in close proximity (typically 1 m) from the different plant items to determine the noise level from each item of plant. Figure 2 shows the location of installed external plant at the rear of the property.
- 4.11 Measurements of the installed plant were undertaken using the following instrumentation:
- | | |
|--------------------------------------|-----------|
| Norsonic precision sound level meter | Type 118 |
| Brüel & Kjær acoustic calibrator | Type 4231 |
- 4.12 The instrumentation was configured to record short-term measurements sufficient to obtain a steady reading with respect to the prevailing ambient noise environment.
- 4.13 Noise from the bakery extract system louvre on the north east façade above the store rear fire escape door was found to be the most significant noise source from the installed plant items.
- 4.14 It is understood that the bakery extract plant only operates during the morning period when the bakery is in use. The Managers Office air conditioning plant is installed with a timer system so that it only operates during daytime and evening hours.

Plant Noise Level Measurement Results

4.15 Plant noise measurement results are shown in full in Appendix C and have been summarised in Table 2.

No.	Description	Measurement Location	Noise Level, L_{Aeq} (dB)
1	Bakery louvre, at side of building	1 m from louvre	49
2	Bakery louvre, above fire escape door on rear facade	1 m from louvre	57
3	Green & Cool refrigeration plant, condensing unit	1 m from unit	50
4	Daikin A/C condensing unit	1 m from unit	52
5	Ventilation louvre on rear façade	1 m from louvre	52
6	Ventilation louvre on rear façade	1 m from louvre	55
7	Plant room louvre on rear facade	1 m from louvre	62

Table 2: Plant Noise Measurement Results

5.0 PLANT NOISE ASSESSMENT

Calculations and Assessment

- 5.1 Calculations have been undertaken to determine the noise level from plant at the nearest residential receptors using standard acoustic theory. Four receptor locations have been selected which represent the closest noise sensitive windows to the different elements of plant at the site. Receptor locations are shown in Figure 2 and described below.
- 5.2 Significant acoustic screening from the building structure and surrounding boundary walls is present between several of the plant items and receptor locations. Due to the distribution of plant and screening effects with respect to the receptor locations, calculations have not included all plant items at each receptor.
- 5.3 A worst case assessment period for daytime and evening periods has been considered when all plant items are operating concurrently. In practice plant operates depending on demand during the daytime and evening hours and it is therefore unlikely all plant items would operate at the same time. During the night-time period only the Green & Cools refrigeration plant unit is operational.

5.4 None of the plant items when assessed individually or cumulatively at the nearest sensitive receptor locations, were found to exhibit an impulsive, tonal or distinctive noise character against the prevailing ambient noise environment. With respect to Camden Borough Council assessment criteria noise from the installed plant should therefore be at least 5 dB lower than the prevailing background noise level for daytime, evening and night-time periods.

5.5 Calculations are shown in full in Appendix C and summarised below in Table 3.

Receptor	Noise Level, dB		
	Daytime (07:00 to 19:00 hours)	Evening (19:00 to 23:00 hours)	Night-time (19:00 to 23:00 hours)
1: Rear of 24 Cricklewood Broadway, First Floor Level	34 $L_{Aeq, 1 \text{ hour}}$	34 $L_{Aeq, 1 \text{ hour}}$	< 20 $L_{Aeq, 15 \text{ min}}$
2: Rear of 24 Cricklewood Broadway, First Floor Level	46 $L_{Aeq, 1 \text{ hour}}$	46 $L_{Aeq, 1 \text{ hour}}$	36 $L_{Aeq, 15 \text{ min}}$
3: Rear of 26 Cricklewood Broadway, First Floor Level	47 $L_{Aeq, 1 \text{ hour}}$	47 $L_{Aeq, 1 \text{ hour}}$	37 $L_{Aeq, 15 \text{ min}}$
4: Rear of 28 Cricklewood Broadway, First Floor Level	37 $L_{Aeq, 1 \text{ hour}}$	37 $L_{Aeq, 1 \text{ hour}}$	< 20 $L_{Aeq, 15 \text{ min}}$

Table 3: Plant Noise Calculation Results

5.6 An assessment of noise from installed plant has been undertaken to determine the rating noise level compared against the representative background noise level at the nearest noise sensitive properties in accordance with Local Planning Authority guidance. Results of the assessment are shown in Tables 4 to 6 for daytime, evening and night-time periods respectively.

	Daytime (07:00 to 19:00 hours) Noise Level at Receptor Location, dB			
	Receptor 1	Receptor 2	Receptor 3	Receptor 4
Representative Background Noise Level, $L_{A90, 1 \text{ hour}}$	45 dB			
Specific Source Noise Level, $L_{Aeq, 1 \text{ hour}}$	34 dB	46 dB	47 dB	37 dB
Assessment Level	-11 dBA	+1 dBA	+2 dBA	-8 dBA

Table 4: Noise Assessment, Daytime

	Evening (19:00 to 23:00 hours) Noise Level at Receptor Location, dB			
	Receptor 1	Receptor 2	Receptor 3	Receptor 4
Representative Background Noise Level, $L_{A90, 1 \text{ hour}}$	44 dB			
Specific Source Noise Level, $L_{Aeq, 1 \text{ hour}}$	34 dB	46 dB	47 dB	37 dB
Assessment Level	-10 dBA	+2 dBA	+3 dBA	-7 dBA

Table 5: Noise Assessment, Evening

	Night-time (23:00 to 07:00 hours) Noise Level at Receptor Location, dB			
	Receptor 1	Receptor 2	Receptor 3	Receptor 4
Representative Background Noise Level, $L_{A90, 15 \text{ min}}$	38 dB			
Specific Source Noise Level, $L_{Aeq, 15 \text{ min}}$	< 20 dB	36 dB	37 dB	< 20 dB
Assessment Level	-18 dBA	-2 dBA	-1 dBA	-18 dBA

Table 6: Noise Assessment, Night-time

- 5.7 Calculations have determined that additional attenuation measures are required to reduce noise emissions from installed plant to achieve Camden Council DP28 criteria. Calculations show that there is no single dominant noise source from the installed plant items. Therefore several measures are proposed below which will assist in reducing overall noise levels from plant at the nearest noise sensitive windows to achieve the relevant criteria.
- 5.8 It is recommended that an attenuator is installed internally between the bakery extract plant louvre on the rear façade (located above rear fire escape door). The attenuator should have a minimum acoustic performance specification as show below in Table 7.

Model	Minimum Sound Reduction Index (dB) per Octave Band Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Attenuator	4	7	13	19	23	23	16	13

Table 7: Attenuator Minimum Acoustic Performance Specification

- 5.9 It is recommended attenuators should also be installed to the ventilation systems between the fan and atmosphere side to reduce noise levels from each respective louvre on the rear façade (shown as 5 and 6 in Figure 2). The attenuators should have a minimum acoustic performance specification as show below in Table 8.

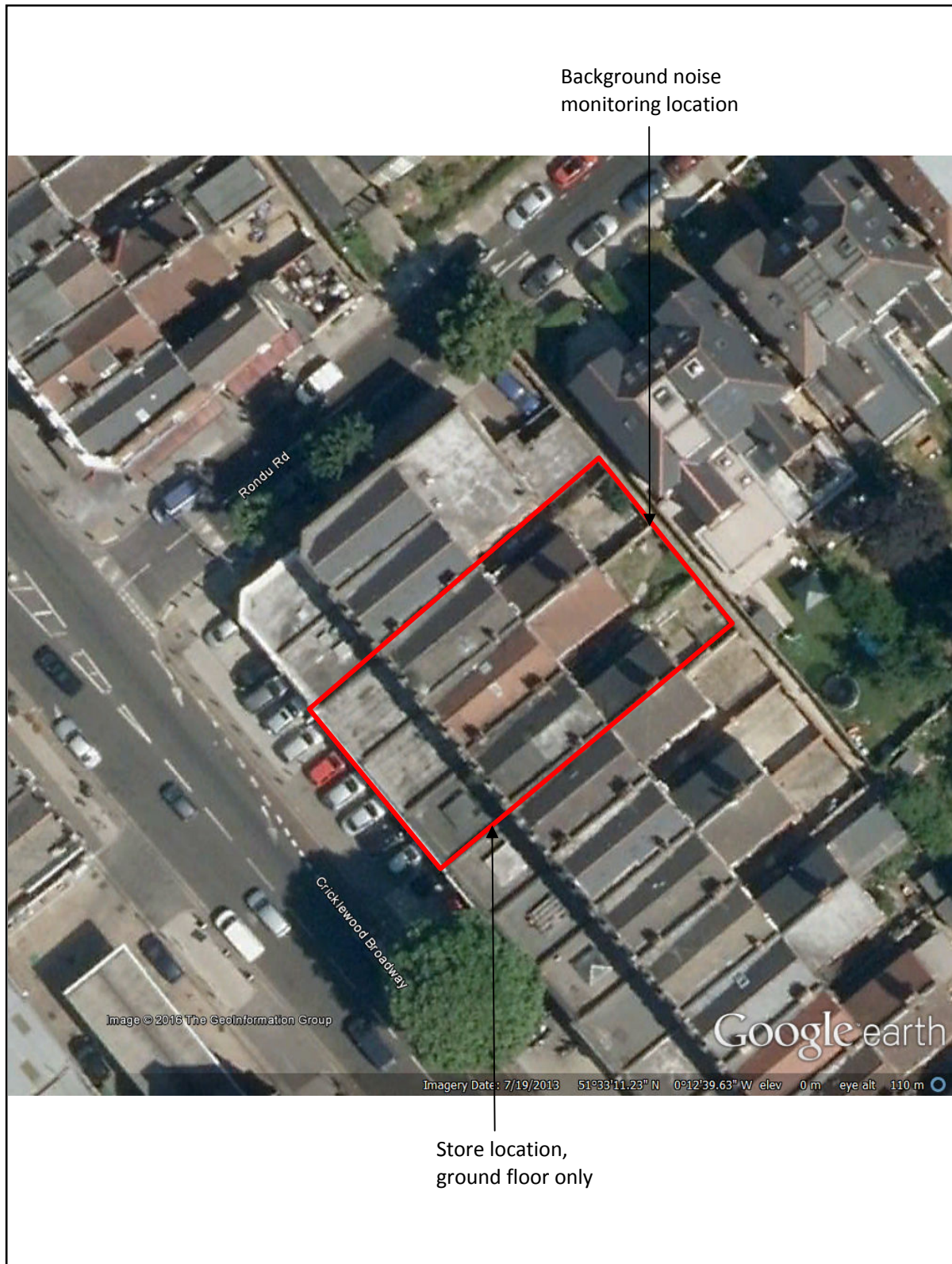
Model	Minimum Sound Reduction Index (dB) per Octave Band Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Attenuator	2	4	8	12	13	13	9	8


Table 8: Attenuator Minimum Acoustic Performance Specification

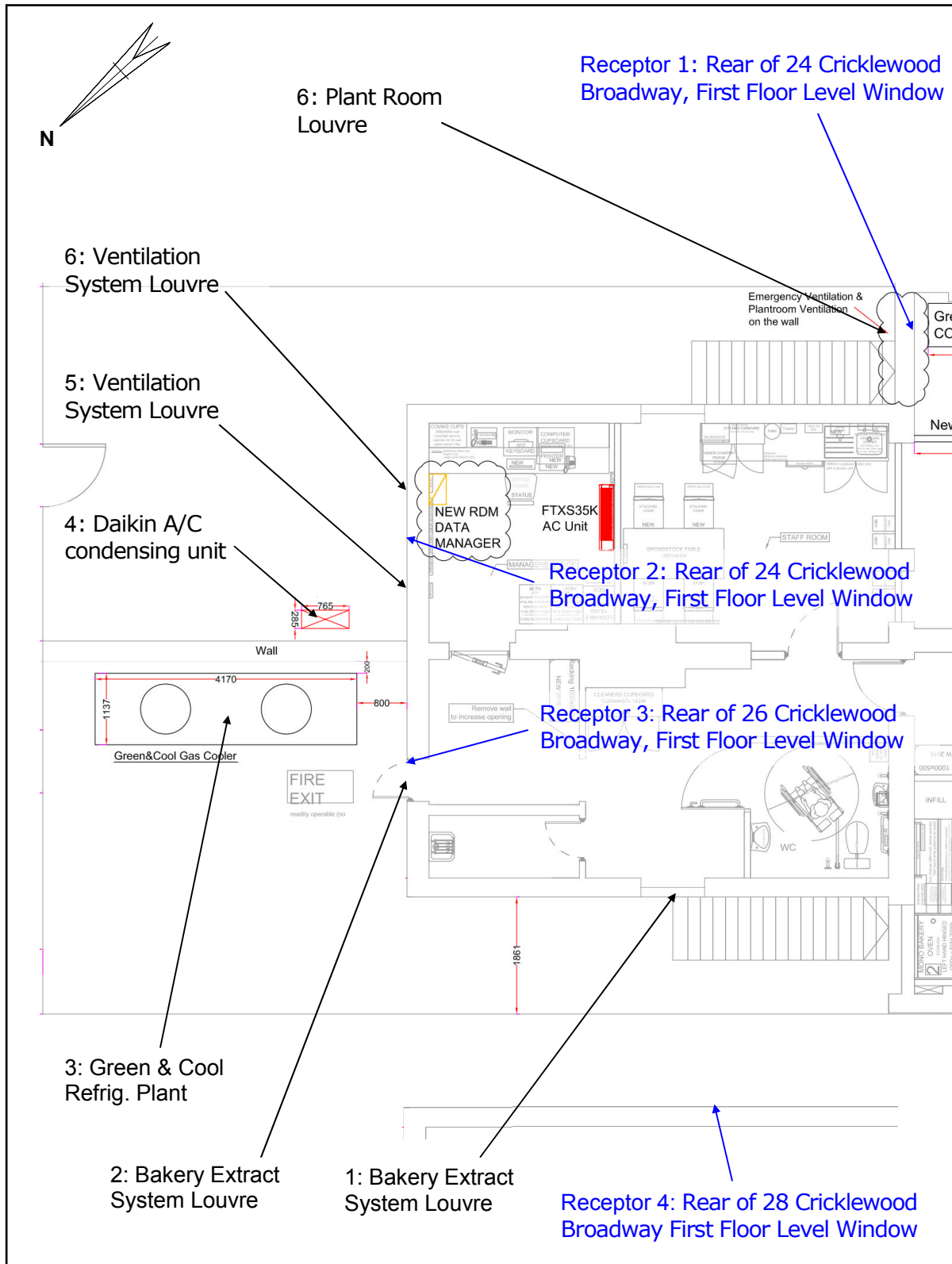
- 5.10 An enclosure should be provided for the Green and Cools chiller plant. Design of the enclosure should prevent direct line of sight between the unit and residential windows above. It is recognised adequate airflow is required for plant to operate correctly and therefore the design should include louvred or hit-and-miss panels. The proposed enclosure should be constructed from timber with non-insignificant mass per unit area (no less than 12.5 kg/m²).
- 5.11 It is recommended that the external Daikin A/C plant unit is relocated to be incorporated within the proposed enclosure.
- 5.12 Calculations have been undertaken to include influence of recommended mitigation measures described above. Calculation results indicate that following installation of mitigation measures noise levels at the nearest noise sensitive receptors would not exceed 39 dB L_{Aeq} during the worst case daytime or evening assessment period and 32 dB L_{Aeq} during the night time period.
- 5.13 On this basis, following installation of proposed mitigation measures, calculations indicated noise from plant will be at least 5 dB lower than the prevailing background noise levels during daytime, evening and night-time periods in accordance with Camden Council planning guidance, and is therefore considered acceptable.


6.0 CONCLUSIONS

- 6.1 The Cooperative Food Group Ltd has instructed 24 Acoustics Ltd to undertake a noise assessment relating to installed mechanical services plant at 22-26 Cricklewood Broadway, London.
- 6.2 Environmental noise measurements have been undertaken to determine the existing background noise levels during daytime, evening and night-time periods.
- 6.3 Calculations have been undertaken which demonstrate that, with suitable mitigation measures, noise emission levels from the proposed plant will achieve the established criteria at the nearest noise sensitive properties.



Project: 22-26 Cricklewood Broadway, London	Title: Site Location Plan		
DWG No: Figure 1	Scale: N.T.S.	Rev: A	
Date: August 2016	Drawn By: JE	Job No: 6277-1	



Project: 22-26 Cricklewood Broadway, London	Title: Plant Layout Plan		
DWG No: Figure 2	Scale: N.T.S.	Rev: A	
Date: August 2016	Drawn By: JE	Job No: 6277-1	

REFERENCES

1. Department for Communities and Local Government. National Planning Policy Framework, 2012.
2. DEFRA, Noise Policy Statement for England, March 2010.
3. Planning Practice Guidance, Department of Communities and Local Government, 2014.
4. British Standards Institution. British Standard 4142. Methods for Rating Industrial and Commercial Sound, 2014.
5. Camden Borough Council. Camden Development Policies (DP28, Noise and Vibration), 2010.
6. British Standards Institution. British Standard 7445: 1991 Description and measurement of environmental noise Part 2 - Acquisition of data pertinent to land use

APPENDIX A: ACOUSTIC TERMINOLOGY

Noise is defined as unwanted sound. The range of audible sound is from 0 to 140 dB. The frequency response of the ear is usually taken to be around 18 Hz (number of oscillations per second) to 18000 Hz. The ear does not respond equally to different frequencies at the same level. It is more sensitive in the mid-frequency range than the lower and higher frequencies and because of this, the low and high frequency components of a sound are reduced in importance by applying a weighting (filtering) circuit to the noise measuring instrument. The weighting which is most widely used and which correlates best with subjective response to noise is the dBA weighting. This is an internationally accepted standard for noise measurements.

For variable sources, such as traffic, a difference of 3 dBA is just distinguishable. In addition, a doubling of traffic flow will increase the overall noise by 3 dBA. The 'loudness' of a noise is a purely subjective parameter, but it is generally accepted that an increase/ decrease of 10 dBA corresponds to a doubling/ halving in perceived loudness.

External noise levels are rarely steady, but rise and fall according to activities within an area. In attempt to produce a figure that relates this variable noise level to subjective response, a number of noise indices have been developed. These include:

- i) The L_{Amax} noise level

This is the maximum noise level recorded over the measurement period.

- ii) The L_{Aeq} noise level

This is "equivalent continuous A-weighted sound pressure level, in decibels" and is defined in British Standard BS 7445 as the "value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval, T, has the same mean square sound pressure as a sound under consideration whose level varies with time".

It is a unit commonly used to describe construction noise and noise from industrial premises and is the most suitable unit for the description of other forms of environmental noise. In more straightforward terms, it is a measure of energy within the varying noise.

iii) The L_{A10} noise level

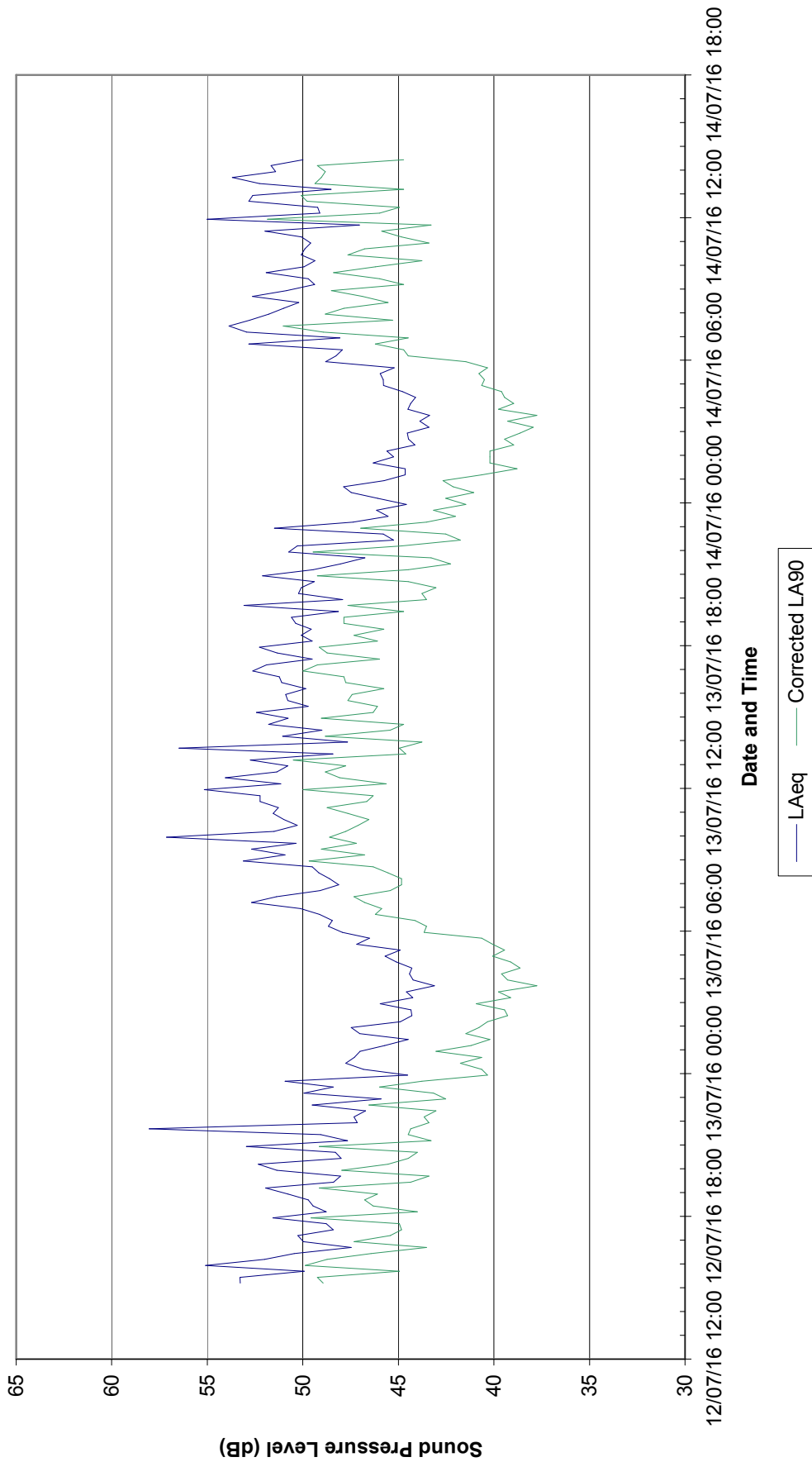
This is the noise level that is exceeded for 10% of the measurement period and gives an indication of the noisier levels. It is a unit that has been used over many years for the measurement and assessment of road traffic noise.

iv) The L_{A90} noise level

This is the noise level that is exceeded for 90% of the measurement period and gives an indication of the noise level during the quieter periods. It is often referred to as the background noise level and is used in the assessment of disturbance from industrial noise.

APPENDIX B: ENVIRONMENTAL NOISE MEASUREMENTS

**Figure B1: Background Noise Measurements, 22-26 Cricklewood Broadway
12th to 14th July 2016**



APPENDIX C: PLANT NOISE MEASUREMENT RESULTS

No.	Plant	LAeq (dB)	Single Octave Band Frequency, Hz Sound Pressure Level (dB)							
			63	125	250	500	1k	2k	4k	8k
1	Bakery louvre, at side of building	49	53	52	50	47	43	40	37	28
2	Bakery louvre, above fire escape door on rear facade	57	60	52	54	51	51	52	46	38
3	Green & Cool refrigeration plant, condensing unit	50	59	53	51	49	45	40	35	27
4	Daikin A/C condensing unit	52	57	61	55	49	46	41	36	26
5	Ventilation louvre on rear façade	52	58	51	55	49	46	43	37	25
6	Ventilation louvre on rear façade	55	53	52	56	56	45	44	37	27
7	Plant room louvre on rear facade	62	58	62	64	59	52	55	52	44

APPENDIX D: PLANT NOISE CALCULATIONS

Unit	63	125	250	500	1k	2k	4k	8k	dB(A)	Comments
Unit Lp										
7) Plant room louvre	58	62	64	59	52	55	52	44	62	Measured at 1 m
Distance Loss										
7) Plant room louvre	-12	-12	-12	-12	-12	-12	-12	-12		Distance to nearest window, 3.8 m
Screening										
7) Plant room louvre	-7	-8	-9	-10	-11	-14	-16	-16		Stairs to FF property screens louvre
Directivity & Other Losses										
7) Plant room louvre	-2	-2	-4	-6	-6	-8	-8	-8		Louvre faces away from rear façade
Levels at nearest sensitive window										
7) Plant room louvre	37	40	40	31	24	22	16	9	34	Noise level from plant
Total									34	Noise level from plant at receptor window

Table D1: Receptor 1, Plant Noise Calculations, Daytime and Evening

Unit	63	125	250	500	1k	2k	4k	8k	dB(A)	Comments
Unit Lp										
2) Bakery louvre, above fire escape door on rear facade	60	52	54	51	51	52	46	38	57	Measured at 1 m
3) Green & Cool refrigeration plant	59	53	51	49	45	40	35	27	50	Measured at 1 m
4) Daikin A/C condensing unit	57	61	55	49	46	41	36	26	52	Measured at 1 m
5) Ventilation louvre on rear façade	58	51	55	49	46	43	37	25	52	Measured at 1 m
6) Ventilation louvre on rear façade	53	52	56	56	45	44	37	27	55	Measured at 1 m
Distance Loss										
2) Bakery louvre, above fire escape door on rear facade	-12	-12	-12	-12	-12	-12	-12	-12		Distance to receptor window, 4 m
3) Green & Cool refrigeration plant	-15	-15	-15	-15	-15	-15	-15	-15		Distance to receptor window, 5.5 m
4) Daikin A/C condensing unit	-11	-11	-11	-11	-11	-11	-11	-11		Distance to receptor window, 3.5 m
5) Ventilation louvre on rear façade	-10	-10	-10	-10	-10	-10	-10	-10		Distance to receptor window, 3 m
6) Ventilation louvre on rear façade	-10	-10	-10	-10	-10	-10	-10	-10		Distance to receptor window, 3 m
Screening										
2) Bakery louvre, above fire escape door on rear facade	0	0	0	0	0	0	0	0		None
3) Green & Cool refrigeration plant	0	0	0	0	0	0	0	0		None
4) Daikin A/C condensing unit	0	0	0	0	0	0	0	0		None
5) Ventilation louvre on rear façade	0	0	0	0	0	0	0	0		None
6) Ventilation louvre on rear façade	0	0	0	0	0	0	0	0		None
Directivity & Other Losses										
2) Bakery louvre, above fire escape door on rear facade	-6	-9	-17	-25	-29	-31	-24	-21		Louvre faces away from rear façade, silencer
3) Green & Cool refrigeration plant	-5	-5	-5	-5	-5	-5	-5	-5		Hit and miss enclosure
4) Daikin A/C condensing unit	-5	-5	-5	-5	-5	-5	-5	-5		Hit and miss enclosure
5) Ventilation louvre on rear façade	-4	-6	-12	-18	-19	-21	-17	-16		Louvre faces away from rear façade, silencer
6) Ventilation louvre on rear façade	-4	-6	-12	-18	-19	-21	-17	-16		Louvre faces away from rear façade, silencer
Levels at nearest sensitive window										
2) Bakery louvre, above fire escape door on rear facade	42	31	25	14	10	9	10	5	22	Noise level from plant
3) Green & Cool refrigeration plant	39	33	31	29	25	20	15	8	31	Noise level from plant
4) Daikin A/C condensing unit	41	45	40	33	30	25	20	10	37	Noise level from plant
5) Ventilation louvre on rear façade	44	36	34	21	18	13	10	0	28	Noise level from plant
6) Ventilation louvre on rear façade	40	36	35	29	17	13	11	1	30	Noise level from plant
Total									39	Combined noise level from plant at nearest sensitive window

Table D2: Receptor 2, Plant Noise Calculations, Daytime and Evening

Unit	63	125	250	500	1k	2k	4k	8k	dB(A)	Comments
Unit Lp										
3) Green & Cool refrigeration plant	59	53	51	49	45	40	35	27	50	Measured at 1 m
Distance Loss										
3) Green & Cool refrigeration plant	-15	-15	-15	-15	-15	-15	-15	-15		Distance to receptor window, 5.5 m
Screening										
3) Green & Cool refrigeration plant	0	0	0	0	0	0	0	0		None
Directivity & Other Losses										
3) Green & Cool refrigeration plant	0	0	0	0	0	0	0	0		None
Levels at nearest sensitive window										
3) Green & Cool refrigeration plant	44	38	36	34	30	25	20	13	36	Noise level from plant
Total									36	Noise level from plant at receptor window

Table D3: Receptor 2, Plant Noise Calculations, Night-time

Unit	63	125	250	500	1k	2k	4k	8k	dB(A)	Comments
Unit Lp										
2) Bakery louvre, above fire escape door on rear facade	60	52	54	51	51	52	46	38	57	Measured at 1 m
3) Green & Cool refrigeration plant	59	53	51	49	45	40	35	27	50	Measured at 1 m
4) Daikin A/C condensing unit	57	61	55	49	46	41	36	26	52	Measured at 1 m
5) Ventilation louvre on rear facade	58	51	55	49	46	43	37	25	52	Measured at 1 m
6) Ventilation louvre on rear facade	53	52	56	56	45	44	37	27	55	Measured at 1 m
Distance Loss										
2) Bakery louvre, above fire escape door on rear facade	-6	-6	-6	-6	-6	-6	-6	-6		Distance to receptor window, 2 m
3) Green & Cool refrigeration plant	-13	-13	-13	-13	-13	-13	-13	-13		Distance to receptor window, 4.5 m
4) Daikin A/C condensing unit	-11	-11	-11	-11	-11	-11	-11	-11		Distance to receptor window, 3.5 m
5) Ventilation louvre on rear facade	-10	-10	-10	-10	-10	-10	-10	-10		Distance to receptor window, 3 m
6) Ventilation louvre on rear facade	-12	-12	-12	-12	-12	-12	-12	-12		Distance to receptor window, 4 m
Screening										
2) Bakery louvre, above fire escape door on rear facade	0	0	0	0	0	0	0	0		None
3) Green & Cool refrigeration plant	-8	-8	-8	-8	-8	-8	-8	-8		Hit and miss enclosure
4) Daikin A/C condensing unit	-7	-8	-9	-10	-11	-11	-14	-16		Screening from wall
5) Ventilation louvre on rear facade	0	0	0	0	0	0	0	0		None
6) Ventilation louvre on rear facade	0	0	0	0	0	0	0	0		None
Directivity & Other Losses										
2) Bakery louvre, above fire escape door on rear facade	-6	-9	-17	-25	-29	-31	-24	-21		Louvre faces away from rear facade, silencer
3) Green & Cool refrigeration plant	-5	-5	-5	-5	-5	-5	-5	-5		Hit and miss enclosure
4) Daikin A/C condensing unit	-5	-5	-5	-5	-5	-5	-5	-5		Hit and miss enclosure
5) Ventilation louvre on rear facade	-4	-6	-12	-18	-19	-21	-17	-16		Louvre faces away from rear facade, silencer
6) Ventilation louvre on rear facade	-4	-6	-12	-18	-19	-21	-17	-16		Louvre faces away from rear facade, silencer
Levels at nearest sensitive window										
2) Bakery louvre, above fire escape door on rear facade	48	37	31	20	16	15	16	11	28	Noise level from plant
3) Green & Cool refrigeration plant	33	27	25	23	19	14	9	1	24	Noise level from plant
4) Daikin A/C condensing unit	34	37	31	23	19	11	4	-6	27	Noise level from plant
5) Ventilation louvre on rear facade	44	36	34	21	18	13	10	0	28	Noise level from plant
6) Ventilation louvre on rear facade	37	34	32	26	14	11	8	-1	27	Noise level from plant
Total									34	Combined noise level from plant at nearest sensitive window

Table D4: Receptor 3, Plant Noise Calculations, Daytime and Evening

Unit	63	125	250	500	1k	2k	4k	8k	dB(A)	Comments
Unit Lp										
3) Green & Cool refrigeration plant	59	53	51	49	45	40	35	27	50	Measured at 1 m
Distance Loss										
3) Green & Cool refrigeration plant	-13	-13	-13	-13	-13	-13	-13	-13		Distance to receptor window, 4.5 m
Screening										
3) Green & Cool refrigeration plant	0	0	0	0	0	0	0	0		None
Directivity & Other Losses										
3) Green & Cool refrigeration plant	0	0	0	0	0	0	0	0		None
Levels at nearest sensitive window										
3) Green & Cool refrigeration plant	46	40	38	36	32	27	22	14	37	Noise level from plant
Total									37	Noise level from plant at receptor window

Table D5: Receptor 3, Plant Noise Calculations, Night-time

Unit	63	125	250	500	1k	2k	4k	8k	dB(A)	Comments
Unit Lp										
2) Bakery louvre, adjacent to stairs	53	52	50	47	43	40	37	28	49	Measured at 1 m
Distance Loss										
2) Bakery louvre, adjacent to stairs	-12	-12	-12	-12	-12	-12	-12	-12		Distance to nearest window, 4.2 m
Screening										
2) Bakery louvre, adjacent to stairs	0	0	0	0	0	0	0	0		None
Directivity & Other Losses										
2) Bakery louvre, adjacent to stairs	0	0	0	0	0	0	0	0		None
Levels at nearest sensitive window										
2) Bakery louvre, adjacent to stairs	40	39	38	34	30	27	24	15	37	Noise level from plant
Total									37	Noise level from plant at receptor window

Table D6: Receptor 4, Plant Noise Calculations, Daytime and Evening