SANDY BROWN

Consultants in Acoustics, Noise & Vibration

024156-R01-A

19 December 2023

The National Hospital of Neurology and Neurosurgery

Environmental noise survey and plant noise assessment report

London, Manchester, Edinburgh, Birmingham, Belfast

post@sandybrown.com
www.sandybrown.com

Sandy Brown Ltd
Registered in England & Wales No. 13227735

Registered Office: 55 Charterhouse Street, London EC1M 6HA

Version	Date	Comments	Author	Reviewer
A	19 Dec 23		Sophie Gray	Andrew Long

Summary

Sandy Brown has been appointed to provide acoustic design advice in relation to the proposed substation/development at The National Hospital of Neurology and Neurosurgery, UCLH, London, W1T.

An environmental noise survey has been carried out to determine the existing sound levels in the area. The noise survey was performed between 11:30 on 7 December 2023 and 10:00 on 13 December 2023.

The results of the survey have been used to set plant noise limits at the nearest external noise sensitive receptors, in line with the London Borough of Camden's requirements

Based on the requirements of the London Borough of Camden and on the results of the noise survey, all plant must be designed to achieve the following:

- The cumulative noise level at 1 m from the worst affected windows of the nearest noise sensitive premise to the west of the site (Queen Court) should not exceed $L_{Aeq,15min}$ 43 dB during the daytime, and $L_{Aeq,15min}$ 38 dB during the night
- The cumulative noise level at 1 m from the worst affected windows of the nearest noise sensitive premise to the east of the site (Great Ormond Street Hospital) should not exceed $L_{Aeq,15min}$ 61 dB during the daytime and night time.

These limits are cumulative and apply with all plant operating under normal conditions. If plant items contain tonal features, the limits will be 5 dB more stringent than those set out above.

An initial assessment of the proposed plant items has been carried out. Noise egress from these units is expected to comply with the relevant limits.

Contents

1 Introduction

Sandy Brown has been appointed to provide acoustic design advice in relation to proposed new condensing units at The National Hospital of Neurology and Neurosurgery, UCLH, London, W1T.

As part of this, an environmental noise survey is required, the purpose of which is to establish the existing background sound levels in the vicinity of nearby noise sensitive premises and to set appropriate limits for noise egress from building services plant.

This report presents the survey method, results of the environmental noise survey, and a discussion of acceptable limits for noise emission from building services plant.

An assessment has been carried out for the proposed plant, which includes new condenser units located on the:

- West of the building, located in a lightwell at basement level
- Between the Chandler Wing and Albany Wing of UCLH NHNN mounted on an existing plant deck located on Level 2
- North east of the building, wall mounted at high level at basement level.

2 Site description

2.1 The site and its surrounding

The site location in relation to its surroundings is shown in Figure 1 (highlighted in yellow). The site is located on Queen Square. To the south of the site lies Great Ormond Street, to the north is Guilford Street and to the east is Powis Place.

Figure 1 Site map (courtesy of Google Earth Pro)

2.2 Nearest noise sensitive premises

The nearest noise sensitive premises are Queen Court located on Queen Square to the north-west of the site and Great Ormond Street Hospital (GOSH) located to the east of the site. These are highlighted in green in Figure 1.

The site lies within the jurisdiction of The London Borough of Camden.

3 Method

Details of the equipment used, the noise indices and the weather conditions during the survey are provided in Appendix A. Further information on the specific survey method is provided in this section.

3.1 Unattended measurements

Unattended noise monitoring was undertaken on the site over 7 days to determine the existing background sound levels at Queen Court.

The unattended measurements were performed over 15-minute periods between 11:30 on 7 December 2023 and 10:00 on 13 December 2023.

The equipment was installed and collected by Sophie Gray.

The measurement position used during the survey is indicated in Figure 1, denoted by 'A'. A photograph showing the measurement location is provided in Figure 2. The location was chosen to be reasonably representative of the noise levels experienced by Queen Court, which is shown in Figure 1. This was at least 3m any reflective surfaces and at least 1.5 m above ground level. The measurements are therefore considered as free field measurements.

Figure 2 Photograph of measurement position 'A'

3.2 Attended measurements.

There are several existing cooling units serving both the NHNN and GOSH in the vicinity of the proposed condensers and the nearest noise sensitive receptors to them, which are those at 1st floor level on the west facade of GOSH (refer to Figure 4). Noise from these units dominates the acoustic climate in the immediate vicinity and it is understood that such noise output is steady and continuous.

Consequently, and in agreement with Camden Council via email on 10 May 2021, short-term attended noise measurements were undertaken to determine the existing background sound levels.

The attended measurements were performed over 5-minute periods between 11:51 and 12:26 on 13 December 2023.

The measurements were undertaken by Sophie Gray.

The area within which measurements were made is indicated in Figure 1, denoted by 'B'. Measurements were made at several locations in close proximity to each other as is shown in Figure 3.

Noise levels at these measurement locations are considered to be representative of those at the nearest noise sensitive receptors to the proposed plant on the east facade of NHNN, and 1.5 m above ground level.

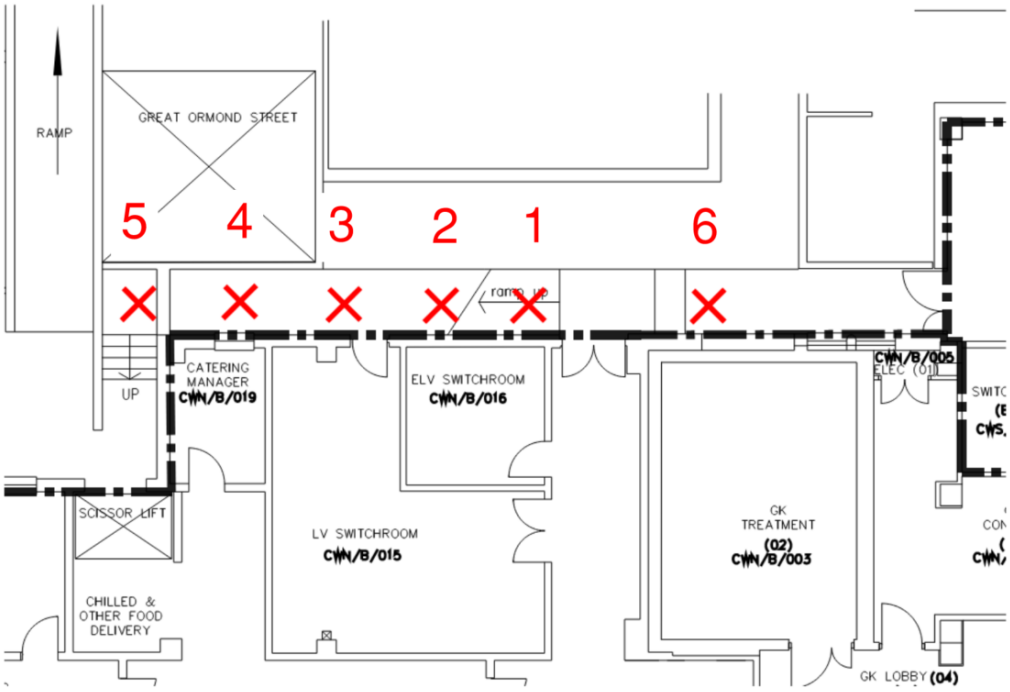


Figure 3 Attended measurement positions

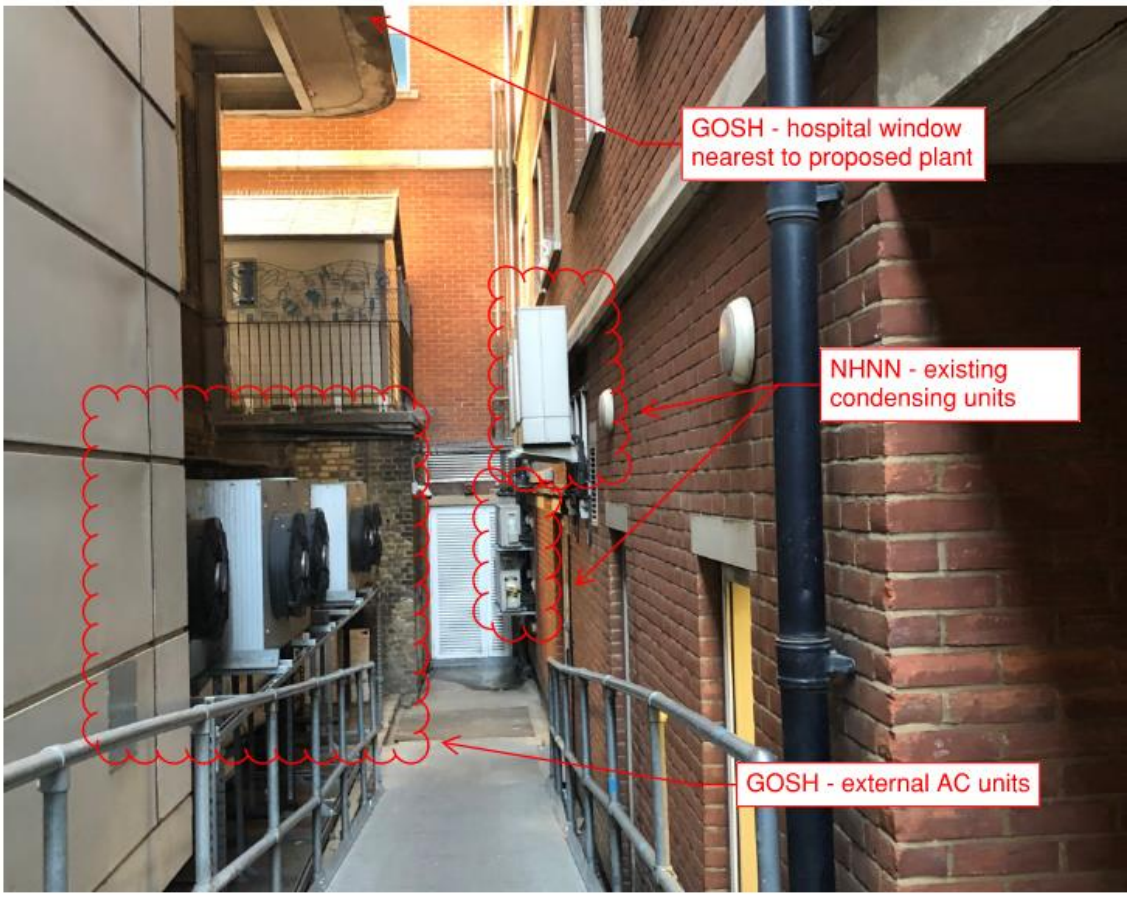


Figure 4 Existing condensing units in the service yard

4 Measurement results

4.1 Observations

The dominant noise source observed at position A during the survey was road traffic. A less significant source observed was pedestrians.

The dominant noise source at position B during the survey was the existing plant items in the vicinity. A less significant source was noise from the surrounding buildings.

4.2 Unattended measurement results

The results of the unattended noise measurements are summarised in the following tables. A graph showing the results of the unattended measurements are provided in Appendix B.

The day and night time ambient noise levels measured during the unattended survey are presented in Table 1.

The measurements taken have been presented as facade levels.

Table 1 Ambient noise levels measured during the survey

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Thursday 7 December 2023	-	49
Friday 8 December 2023	60	53
Saturday 9 December 2023	56	49
Sunday 10 December 2023	54	51
Monday 11 December 2023	56	56
Tuesday 12 December 2023	57	50
Average	57	51

The minimum background sound levels measured during the unattended survey are given in Table 2.

Table 2 Minimum background sound levels measured during the survey at position A

Date	Daytime (07:00 – 23:00) $L_{A90,15min}$ (dB)	Night (23:00 – 07:00) $L_{A90,15min}$ (dB)
Thursday 7 December 2023	47 *	45
Friday 8 December 2023	49	46
Saturday 9 December 2023	49	45
Sunday 10 December 2023	47	45
Monday 11 December 2023	46	44

Date	Daytime (07:00 – 23:00) $L_{A90,15min}$ (dB)	Night (23:00 – 07:00) $L_{A90,15min}$ (dB)
Tuesday 12 December 2023	46	44
Wednesday 13 December 2023	49 *	-

* Measurement not made over full period due to monitoring start and end time

The lowest background sound levels measured during the survey were $L_{A90,15min}$ 46 dB during the daytime and $L_{A90,15min}$ 44 dB at night.

In line with BS 4142:2014, for the purpose of analysis and establishing representative background sound levels, day and night time typical levels have been quantified using statistical analysis from the continuous logging measurements.

Daytime and night time statistical analysis of representative values for the site are given in Figure 5.

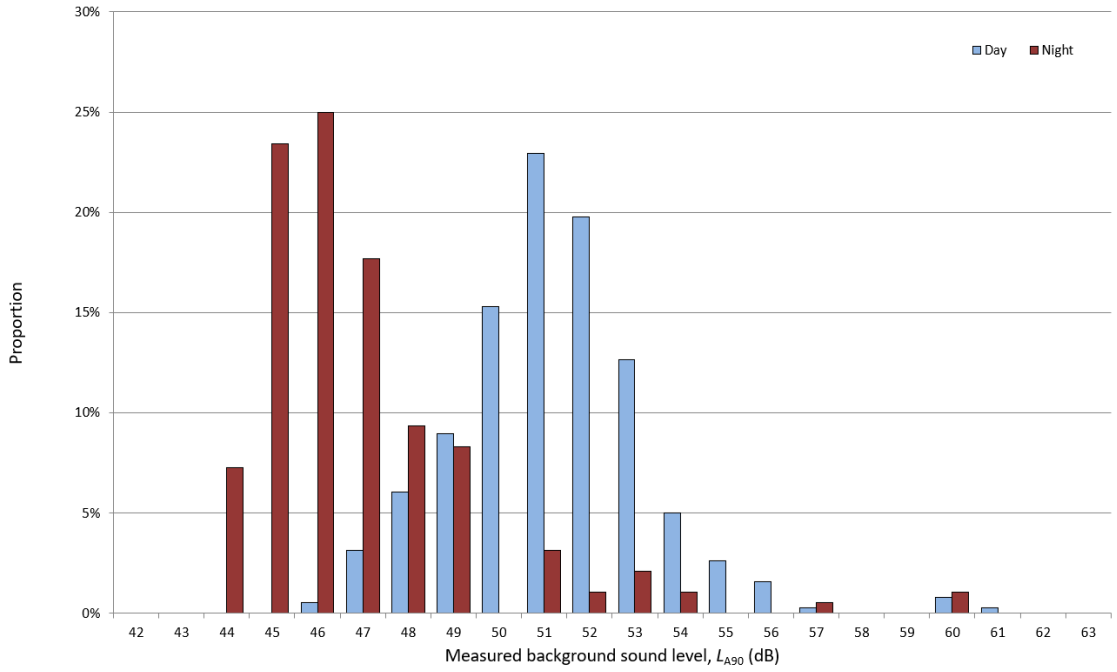


Figure 5 Representative night time and daytime background sound levels at position A

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 50 dB during the daytime and $L_{A90,15min}$ 45 dB at night.

4.3 Attended measurements

The results of the attended measurements are presented in Table 3. The measurements taken were considered to be facade levels.

Table 3 Background noise levels measured at position B

Measurement	Time	Sound pressure level $L_{A90,5min}$ (dB)
1	12:39	71
2	12:47	72
3	12:56	73
4	13:03	71
5	13:09	71
6	13:15	73
Average		72

The lowest background sound level measured was $L_{A90,5min}$ 71 dB at positions 1, 4 and 5 and this is considered to be representative of noise at the window of the nearest noise sensitive receptor (GOSH).

5 Building services noise egress limits

5.1 Standard guidance

BS 4142:2014:+A1:2019 *Methods for rating and assessing industrial and commercial sound* (BS 4142) provides a method for assessing noise from items such as building services plant against the existing background sound levels at nearby noise sensitive premises.

BS 4142 suggests that if the noise level is 10 dB or more higher than the existing background sound level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background sound level, it is likely to be an indication of an adverse impact. If the level does not exceed the background sound level, it is an indication of having a low impact.

If the noise contains 'attention catching features' such as tones, bangs etc, a penalty, based on the type and impact of those features, is applied. This is discussed in Appendix C.

5.2 Local Authority criteria

The Camden Local Plan 2017 employs the idea of "effect levels" as described in the National Planning Policy Framework and Planning Practice Guidance. The effect levels are: No Observed Effect Level (NOEL), Lowest Observed Adverse Effect Level (LOAEL), and Significant Observed Adverse Effect Level (SOAEL). There are numerical values assigned to each effect level.

The Camden Local Plan 2017 suggest that noise from industrial and commercial sources should be designed to be 10 dB below the background noise level (15 dB below if tonal components are present).

5.3 Limits

5.3.1 External noise sensitive premises

Based on achieving a noise level that is at or below the LOAEL, the requirements of the London Borough of Camden (Section 5.2) and the measurement results, the cumulative noise level resulting from the operation of all new plant at 1 m from the worst affected windows of Queen Court and GOSH should not exceed the limits set out in Table 4 and Table 5. These are presented as facade limits. The limits at Queen Court have been corrected relative to the measured free-field background sound levels by the addition of 3 dB (as per the guidance provided in BS 8233:2014 Section G.2.1).

Table 4 Plant noise limits at 1 m from the nearest noise sensitive premises – Queen Court

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises ($L_{Aeq,15min}$ dB)
Daytime (07:00-23:00)	43
Night-time (23:00-07:00)	38

Table 5 Plant noise limits at 1 m from the nearest noise sensitive premises – Great Ormond Street Hospital

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises ($L_{Aeq,15min}$ dB)
Daytime (07:00-23:00)	61
Night-time (23:00-07:00)	61

If the plant contains audible tonal elements the limits will be 5 dB more stringent.

5.4 Assessment

An assessment has been carried out to determine the noise from the proposed plant at the nearest noise sensitive receptors.

5.4.1 Proposed plant

The proposed plant comprises several condensing units located at different locations around the site. These locations are shown in Figure 6 and are labelled 1, 2 and 3.

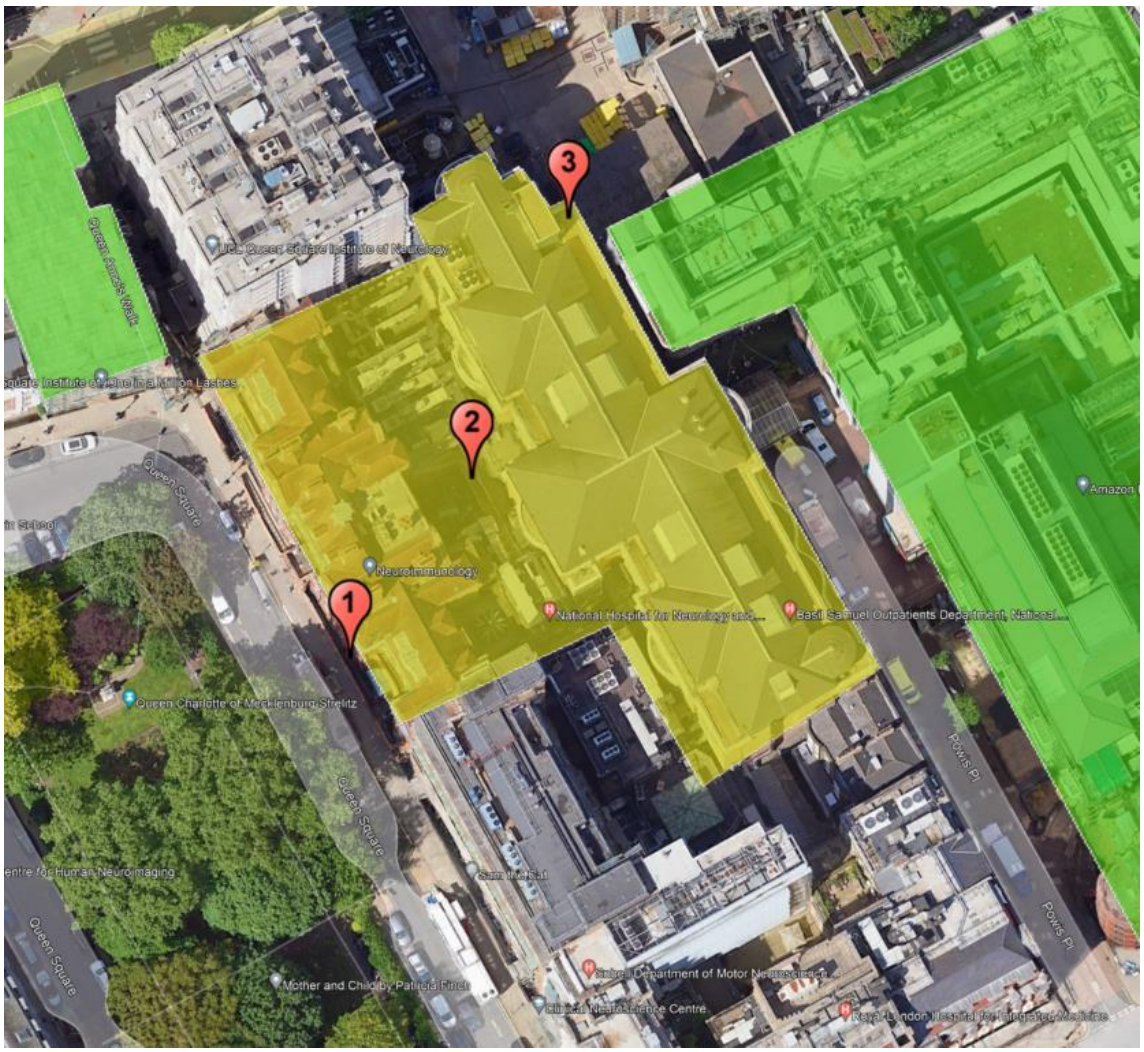


Figure 6 Proposed plant locations

Position 1

The proposed plant at position 1 comprises three condensing units which are located in a lightwell at basement level and are shown in Figure 7.

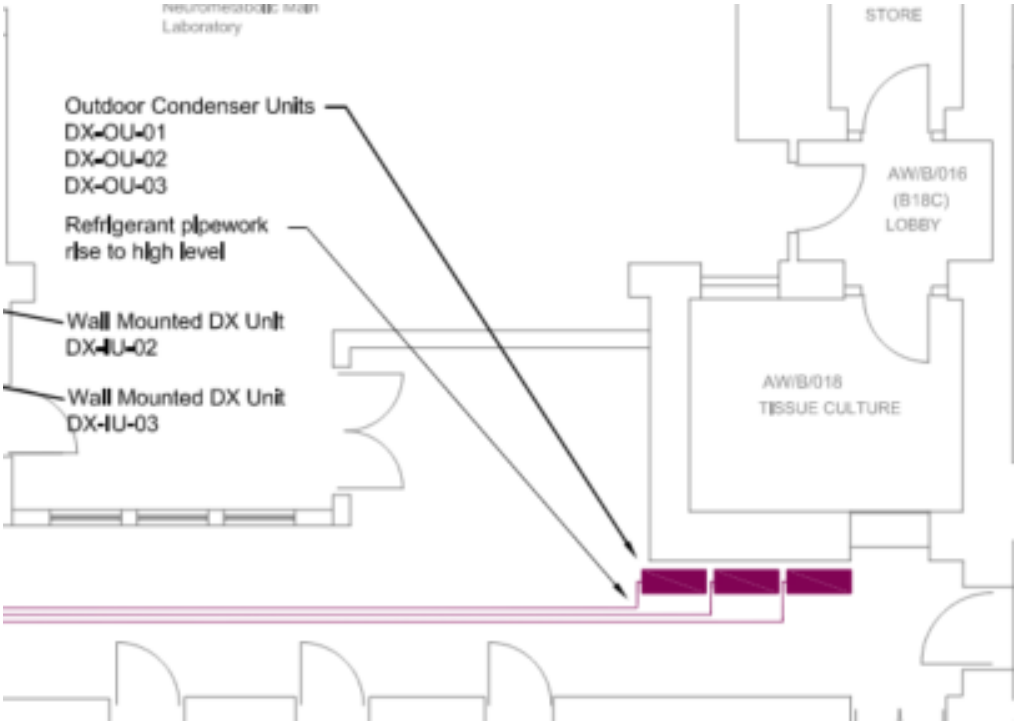


Figure 7 Condensing units at position 1

The sound pressure levels are given in the manufacturer data sheets, provided by Arup, and have been summarised in Table 6.

Table 6 Noise data for plant items located at position 1

Item ref	Plant item	Sound pressure level @ 1m (dB) at Octave Band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
DX-0U-01	Daikin RXM25N9	51	51	49	47	43	39	34	27	49
DX-0U-02	Mitsubushi PUZ-ZM50VKA	58	51	45	44	40	37	32	31	46
DX-0U-03	Mitsubushi PUZ-ZM50VKA	58	51	45	44	40	37	32	31	46

Position 2

The proposed plant at position 2 is going to be mounted on an existing plant deck located on Level 2 and is shown in Figure . This is located between the Chandler Wing and Albany Wing of UCLH.

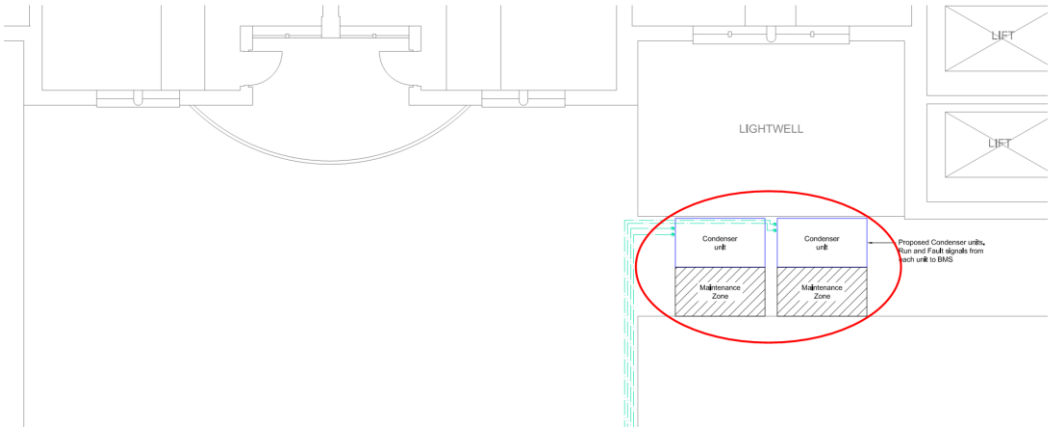


Figure 8 Condensing units at position 2

The plant items consist of two outdoor condensing units, which are both to be Airedale CR65.

The sound power levels (SWL) are given in the manufacturer data sheets, provided by Arup, and have been summarised in Table 7.

Table 7 Noise data for plant items located at position 2

Plant item	Sound power level (Hz) in Octave Band centre frequencies (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
Airedale CR65	85	90	77	77	76	73	66	65	81

Position 3

The proposed plant at position 3 comprises four condensing units that are to be wall mounted at basement level in the service yard as is shown in Figure 9.

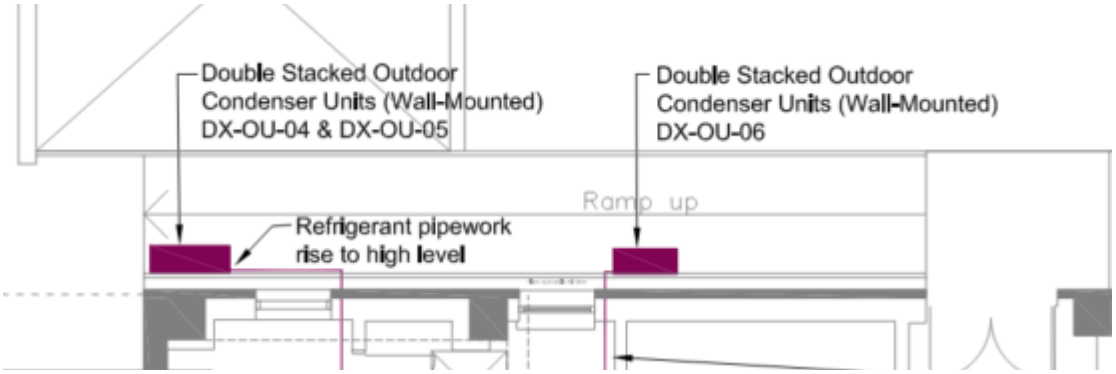


Figure 9 Condensing units at position 3

The sound pressure levels are given in the manufacturer data sheets, provided by Arup, and have been summarised in Table 8.

Table 8 Noise data for plant items located at position 3

Item ref	Plant item	Sound pressure level @ 1m (dB) at Octave Band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
DX-0U-04	Mitsubushi P140YHA	54	56	52	50	48	46	39	34	53
DX-0U-05	Mitsubushi P140YHA	54	56	52	50	48	46	39	34	53
DX-0U-06	Daikin RXM25N9	51	51	49	47	43	39	34	27	49
DX-0U-07	Daikin RXM25N9	51	51	49	47	43	39	34	27	49

5.4.2 Assessment

Noise from the proposed plant has been assessed to the nearest noise sensitive receptors. The assessment has considered sound directivity, acoustic screening from the building geometry, distance attenuation and a facade correction. The results are presented in Table 9.

Table 9 Noise emissions to the nearest external noise sensitive receptor

Receptor	Noise emissions at 1 m from noise sensitive premises ($L_{Aeq,15min}$ dB)
Queen Court	25
Great Ormond Street Hospital	54

The calculated noise emissions from the external plant at the nearest noise sensitive receptors are lower than limits set out in Table 4 and Table 5, thereby demonstrating compliance with the London Borough of Camden's requirements.

6 Conclusion

An environmental noise survey has been carried out at two locations, to determine the existing background sound levels in the area.

The results of the survey have been used to set plant noise limits at the nearest external noise sensitive receptor, in line with the London Borough of Camden's requirements.

Based on the requirements of the London Borough of Camden and on the results of the noise survey, all plant must be designed to achieve the following:

- The cumulative noise level at 1 m from the worst affected windows of the nearest noise sensitive premises to the west of the site (Queen Court) should not exceed $L_{Aeq,15min}$ 43 dB during the daytime, and $L_{Aeq,15min}$ 38 dB during the night
- The cumulative noise level at 1 m from the worst affected windows of the nearest noise sensitive premises to the east of the site (GOSH) should not exceed $L_{Aeq,15min}$ 61 dB during the daytime and night time.

These limits are cumulative and apply with all plant operating under normal conditions. If plant items contain tonal features, the limits will be 5 dB more stringent than those set out above.

An assessment of the proposed plant items associated with the development has been carried out. The proposed plant items are expected to comply with the relevant noise limits, such that no mitigation is deemed necessary.

Appendix A

Survey details

Equipment

A Rion NL-32 sound level meter was used to undertake the unattended measurements. A Bruel and Kjaer 2250 was used to undertake the attended measurements. The calibration details for the equipment used during the survey are provided in Table 1.

Table 1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
B&K 2250 (D)				
Sound level meter	2250/3011195	Brüel & Kjær	2 Dec 24	UCRT22/2430, UCRT22/2431
Microphone	4189/3086746	Brüel & Kjær	2 Dec 24	UCRT22/2430, UCRT22/2431
Pre-amp	ZC0032/25565	Brüel & Kjær	2 Dec 24	UCRT22/2430, UCRT22/2431
Calibrator	4231/3017676	Brüel & Kjær	2 Dec 24	UCRT22/2426
Rion NL-52 (F)				
Sound level meter	NL-52/00242702	Rion	27 Feb 25	TCRT23/1190
Microphone	UC-59/06185	Rion	27 Feb 25	TCRT23/1190
Pre-amp	NH-25/32730	Rion	27 Feb 25	TCRT23/1190
Calibrator	CAL200/4499	Larson Davis	24 Feb 25	TCRT23/1184

Calibration of the sound level meters used for the tests is traceable to national standards. The calibration certificates for the sound level meters used in this survey are available upon request.

The sound level meters and microphones were calibrated at the beginning and end of the measurements using their respective sound level calibrators. No significant deviation in calibration occurred.

Noise indices

The equipment was set to record a continuous series of broadband sound pressure levels. Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period with a fast time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

The L_{A90} is considered most representative of the background sound level for the purposes of complying with any local authority requirements.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

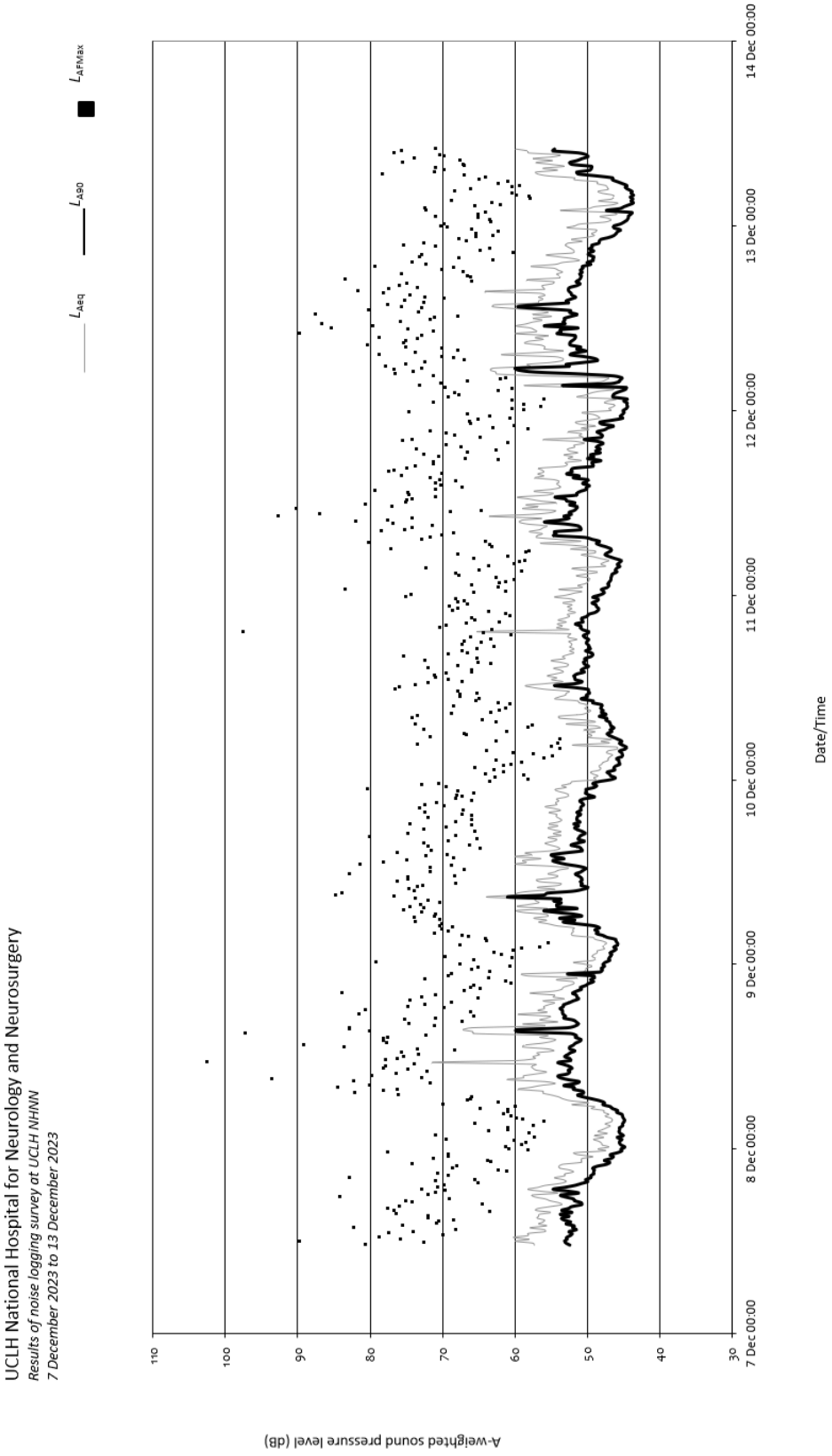
A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures.*

Weather conditions

During the unattended noise measurements between 7 December 2023 and 13 December 2023, weather reports for the area indicated that temperatures varied between 0°C at night and 16°C during the day, and the wind speed was less than 3 m/s.

Appendix B

Results of unattended measurements at position A


UCLH National Hospital for Neurology and Neurosurgery
Results of noise logging survey at UCLH NHNN
7 December 2023 to 13 December 2023
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
110
100
90
80
70
60
50
40
30
7 Dec 00:00
8 Dec 00:00
9 Dec 00:00
10 Dec 00:00
11 Dec 00:00
12 Dec 00:00
13 Dec 00:00
14 Dec 00:00
Date/Time