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Queens Mary's Hospital CDC
Sidcup, London

Preliminary Planning Compliance Report
Report 26957.PCR.01

Gardiner & Theobald LLP
10 South Crescent
London
WC1E 7BD

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List of Attachments

1.0 INTRODUCTION

KP Acoustics Ltd has been commissioned by Gardiner & Theobald, 10 South Crescent, London, WCIE 7BD, to undertake a noise impact assessment of a proposed plant unit installation serving the building at Frognal Avenue, Sidcup, London, DA14 6LT.

A 24-hour environmental noise survey has been undertaken on site and the background noise levels measured have been used to determine daytime and night-time noise emission criteria for a proposed plant installation in agreement with the planning requirements of Bexley. Calculations have been used to demonstrate the feasibility of the plant unit installation to satisfy the emissions criterion at the closest noise-sensitive receiver. Mitigation measures are outlined as appropriate.

2.0 SITE SURVEYS

2.1 Site Description

As shown in Figure 2.1, the site is bounded by a building to the north, a grass field to the west, Frognal Avenue to the south, and a vehicle loading bay to the east.

Figure 2.1 Site Location Plan (Image Source: Google Maps)

Initial inspection of the site revealed that the background noise profile at the monitoring location was typical of a hospital site with access into the rear of the building.

2.2 Environmental Noise Survey Procedure

Continuous automated monitoring was undertaken for the duration of the noise survey between 11:30 on 06/09/2023 and 11:30 on 07/09/2023.

The environmental noise measurement position, proposed plant installation locations, and the closest noise sensitive receiver relative to the plant installations are described within Table 2.1 and shown within Figure 2.2.

Icon	Descriptor	Location Description
	Noise Measurement Position 1	The microphone was attached to a fence post, with the microphone protruding over the side of the façade. The microphone was positioned within free-field conditions at least 1.5 metres from the nearest surface.
	Noise Measurement Position 2	The microphone was attached to a fence post, with the microphone protruding over the side of the façade. The microphone was positioned within free-field conditions at least 1.5 metres from the nearest surface.
	Proposed Plant Installation Location/s	Proposed plant installations are outlined in Section 5.1.
	Nearest Noise Sensitive Receiver (NSR)	1st floor window of Hawthorn building.
	Line dividing criteria for noise sensitive receivers	Border defining where noise requirements for residential properties end, and professional workspaces begin. Referenced in table 4.2

Table 2.1 Measurement position and description

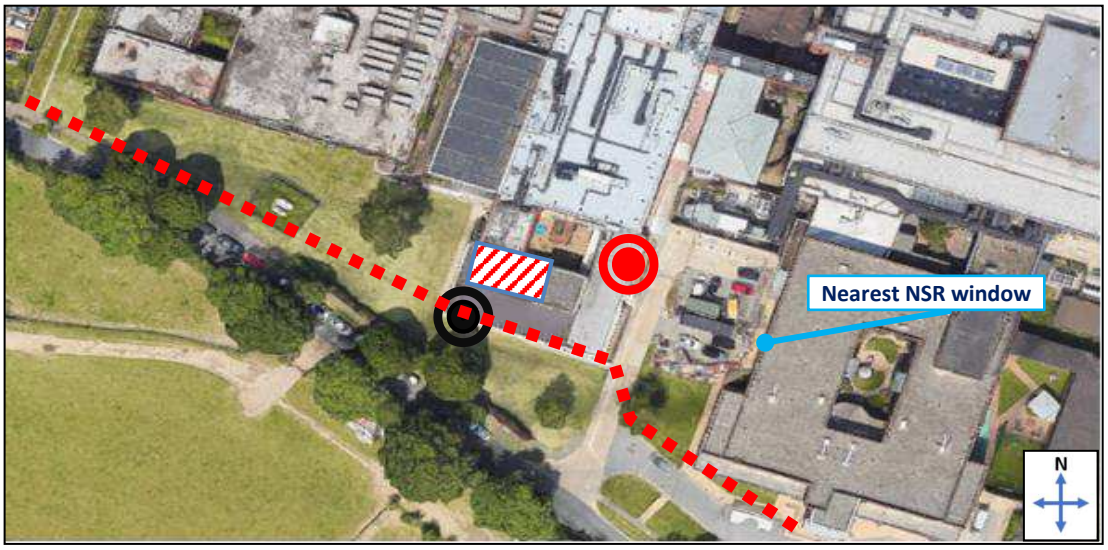

Figure 2.2 Site measurement position, identified receiver and proposed plant unit installation (Image Source: Google Maps)

The choice of the position was based both on accessibility and on collecting representative noise data in relation to the nearest noise sensitive receiver and the proposed plant installation.

Weather conditions were generally dry with light winds and therefore suitable for the measurement of environmental noise. The measurement procedure complied with ISO 1996-2:2017 Acoustics '*Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels*'.

2.3 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed. The equipment used is described within Table 2.2.

Measurement instrumentation		Serial no.	Date	Cert no.
Noise Kit 30	NTI Audio XL2 Class 1 Sound Level Meter	A2A-21149-E0	06/09/2023	UK-22-079
	Free-field microphone NTI Acoustics MC230A	A23572		
	Preamp NTI Acoustics MA220	10997		
	NTI Audio External Weatherproof Shroud	-	-	-
Noise Kit 24	NTI Audio XL2 Class 1 Sound Level Meter	A2A-21175-E0	06/09/2023	UK-22-066
	Free-field microphone NTI Acoustics MC230A	A23583		
	Preamp NTI Acoustics MA220	10992		
	NTI Audio External Weatherproof Shroud	-		

Table 2.3 Measurement instrumentation

3.0 RESULTS

The $L_{Aeq:\,5min}$, $L_{Amax:\,5min}$, $L_{A10:\,5min}$ and $L_{A90:\,5min}$ acoustic parameters were measured throughout the duration of the survey. Measured levels are shown as time history in Figures 26957.TH1-2.

Representative background noise levels are shown in Table 3.1 for daytime and night-time. It should be noted that the representative background noise level has been derived from the most commonly occurring $L_{A90,5\ min}$ levels measured during the environmental noise survey

undertaken on site, as shown in 26957.Daytime L90.TH1-2 and 26957.Night-time L90.TH1-2 attached.

Time Period	Representative background noise level L_{A90} dB(A)	
	Measurement Position 1	Measurement Position 2
Daytime (07:00-23:00)	51	55
Night-time (23:00-07:00)	43	51

Table 3.1 Representative background noise levels

4.0 NOISE ASSESSMENT GUIDANCE

4.1 Local Authority Guidance

The guidance provided by The London Borough of Bexley for noise emissions of new plant in this instance is as follows:

"The rating level of noise emitted from fixed plant on the site shall be 5dB below the existing representative background level at any time. The noise levels shall be determined 1 metre from the façade of residential properties with measurements and assessments made according to BS 4142: 2014. The approved measures shall be installed and maintained thereafter".

4.2 Noise Emissions Criterion

The criteria for external plant noise emissions at the nearest noise sensitive receptors have been set as shown in the following table. Please note that Table 5.1 should be read in conjunction with Figure 2.2. The red line in Figure 2.2 divides the sensitive receivers by residential (south of red line), and for professional workplaces (north of red line).

Time Period	Maximum Plant Noise Emissions Criteria (dBA) at Nearest Noise Sensitive Receptor (NSR)	
	NSRs to the south of red line	NSRs to the north of red line
Daytime (07:00 to 23:00)	< 46	< 50
Night-time (23:00 to 07:00)	< 38	< 46

Table 4.1 Proposed noise emissions criteria

5.0 NOISE IMPACT ASSESSMENT

5.1 Proposed Plant Installations

It is understood that the proposed plant installation is comprised of the following units:

- 2 no. Chiller Units
- 1 no. Air Handling Unit

The proposed installation location for the proposed plants will be in an outdoor enclosure on the ground floor, as shown in Figure 2.2 above.

The noise emission levels as provided by the manufacturer for the units are shown in Table 5.1.

Unit	Descriptor	Noise Level (dB) at Octave Frequency Band (Hz)								Overall (dBA)
		63	125	250	500	1k	2k	4k	8k	
Chiller Units	SPL@1m (dB)	65	68	68	70	68	60	55	65	76
Air Handling Units	Air inlet Sound Power Level@3m (Lw)	54	62	60	58	45	36	22	22	57
	Extract Air Outlet Sound Power Level (Lw)	71	87	81	79	77	73	68	64	82
	Breakout Noise Sound Power Level (Lw)	59	66	72	66	58	46	38	29	67

Table 5.1 Plant Units Noise Emission Levels as provided by the manufacturer

The closest noise sensitive receiver to the proposed installation location has been identified as being a window of the Hawthorns building located approximately 30 metres from the proposed plant installation location, as shown in Figure 2.2.

5.2 Calculations

Taking all acoustic corrections into consideration, the noise level contribution expected at the closest noise sensitive window from the proposed plant would be as shown in Table 5.2. Detailed calculations are shown in Appendix B.

Receiver	Criterion	Noise Level at 1m From the Closest Noise Sensitive Window
1st Floor Window of 1 Hawthorns Building	46dB(A)	46dB(A)

Table 5.2 Predicted noise level and criterion at nearest noise sensitive location

As shown in Appendix B and Table 5.2, transmission of noise to the nearest sensitive windows due to the effects of the chiller and air handling unit installations satisfies the emissions criterion of the Bexley Council, providing that the mitigation measures outlined in Section 6 are implemented.

6.0 NOISE CONTROL MEASURES

In order to achieve the specific sound level and subsequent rating level shown in the assessment above, the following noise control strategy should be adopted.

6.1 Open Top Plantroom

We would recommend that the plantroom walls surrounding the building services plant, should be built according to the following:

- The barrier should be built to a minimum height of 2.5 metres
- The barrier should have a minimum density of 10kg/m^3
- The barrier should fully surround the plant.

6.2 Plant Locations

In order to obstruct the direct line of sight from the chillers to the nearest noise sensitive window, we would recommend that they are moved closer to the barrier. The chillers should be located 4 metres and 8.5 metres from the barrier, as shown in the following figure:

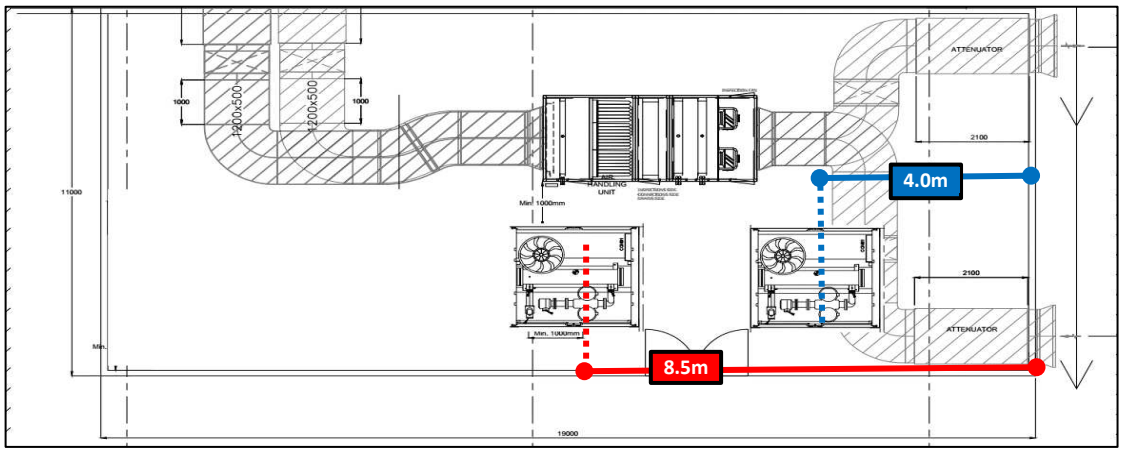

Figure 6.1 New proposed Chiller Unit locations

6.3 Anti-Vibration Mounting Strategy

In the case of all plant units, appropriate anti-vibration mounts should be installed in order to ensure that vibrations do not give rise to structure-borne noise. Appendix C outlines detailed advice in order to ensure that the system installer selects the appropriate anti-vibration mount for the installation.

It is the supplier's responsibility to ensure that all mountings offered are suitable for the loads, operating and environmental conditions which will prevail.

7.0 CONCLUSION

An environmental noise survey has been undertaken at Queen Mary's Hospital CDC, Sidcup, London, DA14 6LT, by KP Acoustics Ltd between 11:30 on 06/09/2023 and 11:30 on 07/09/2023. The results of the survey have enabled a minimum/representative background noise level to be established/set.

A maximum noise emissions criteria for the proposed plant unit installations has been set based on the requirements of Bexley for new plant unit installations.

Calculations show that noise emissions from the Chiller and Air Handling unit installations would meet the requirements of Bexley Council, providing that the mitigation measures outlined in Section 6 are implemented. The proposed plant installation would result in a low magnitude of impact and an indication of low adverse impact on the closest receiver, in accordance with BS4142:2014.

Queen Mary's Hospital - Position 1
Environmental Time History
06/09/2023 to 07/09/2023

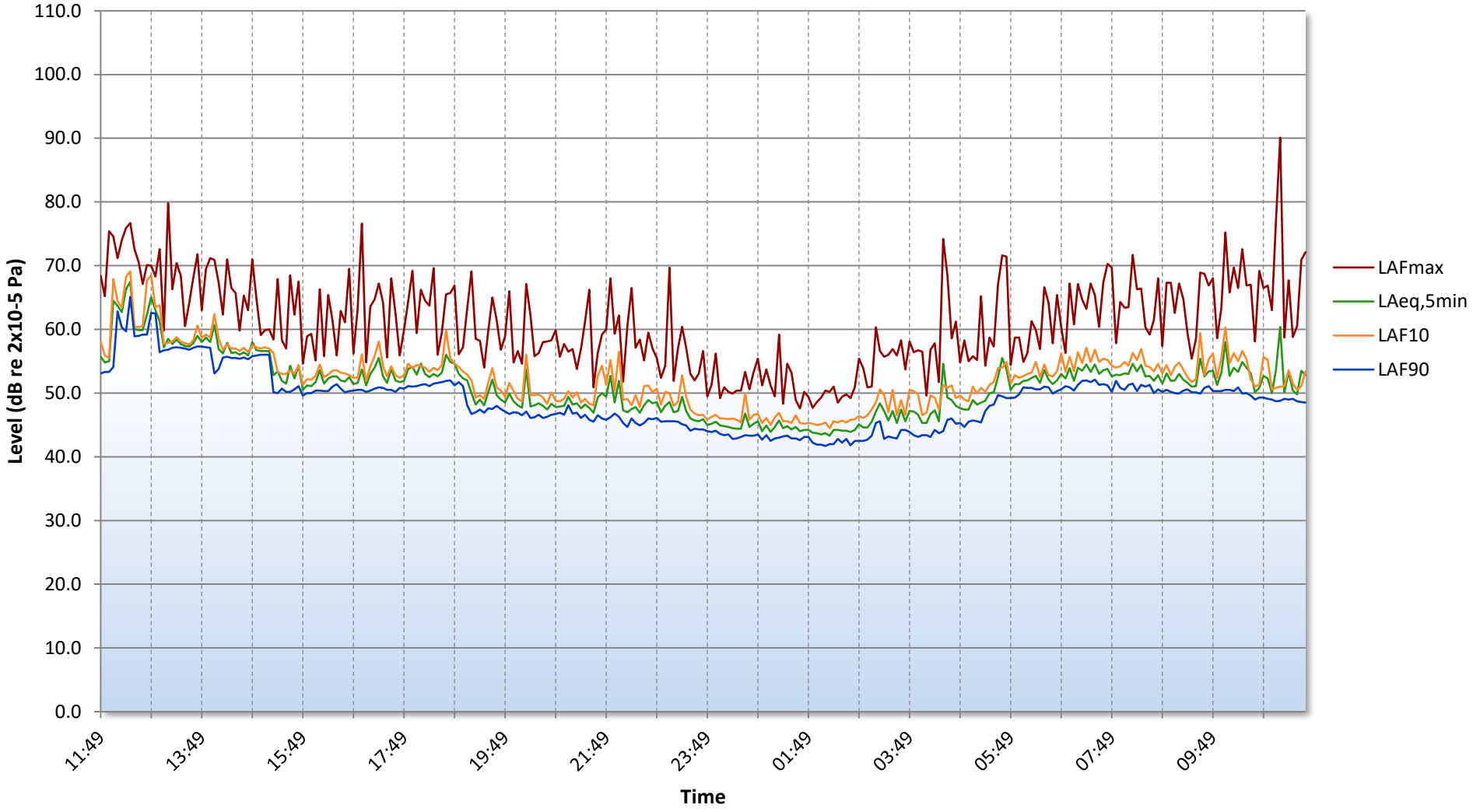

Figure 26957.TH1

Queen Mary's Hospital, Sidcup - Position 2
Environmental Time History
06/09/2023 to 07/09/2023

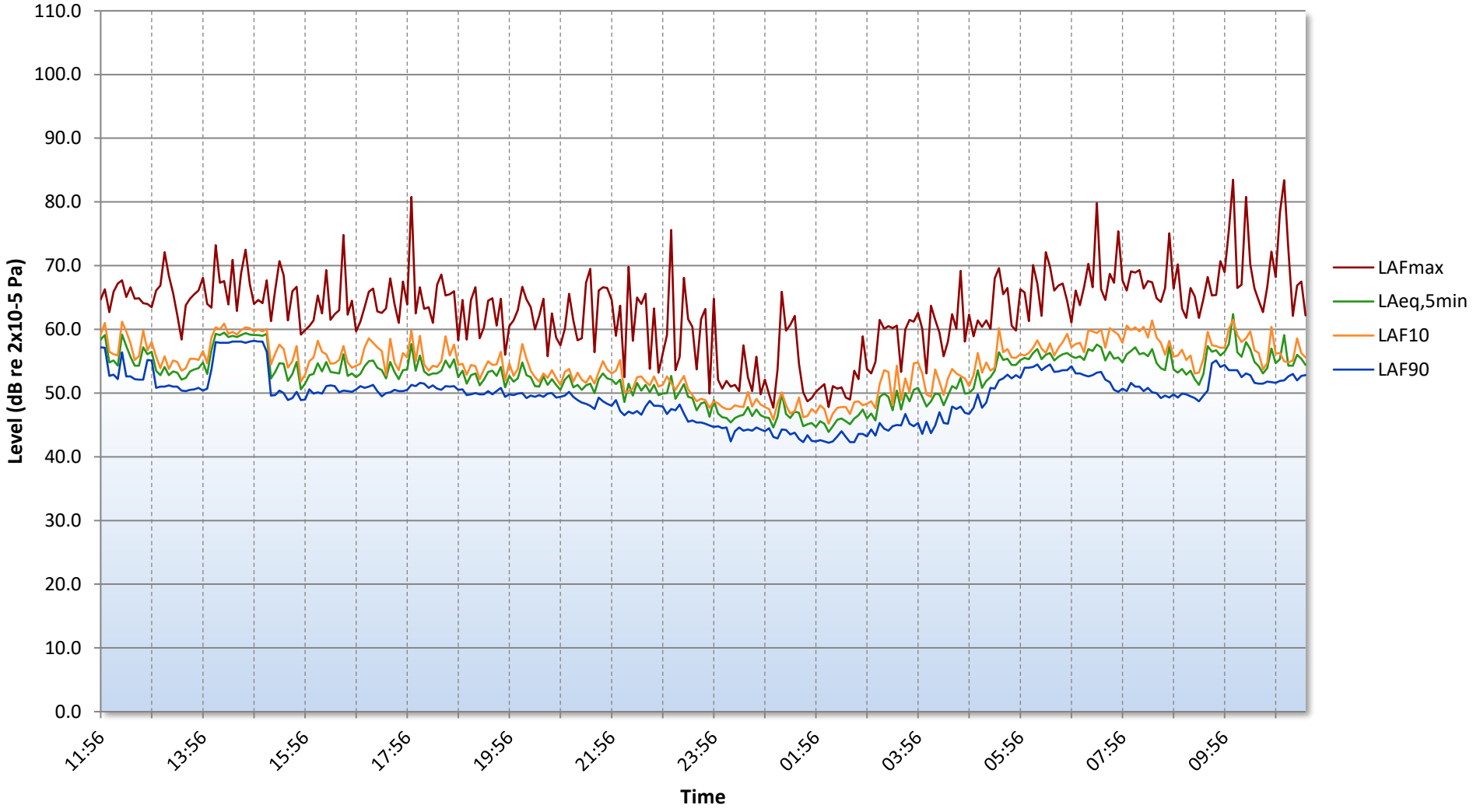

Figure 26957.TH2

APPENDIX A

GENERAL ACOUSTIC TERMINOLOGY

Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the 'decibel', dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of 10^{13} units, that only a logarithmic scale is the sensible solution for displaying such a range.

Decibel scale, 'A' weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for no more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise.

L_{90}

This is the level exceeded for no more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Environmental noise terms are defined in BS7445, *Description and Measurement of Environmental Noise*.

APPENDIX A

APPLIED ACOUSTIC TERMINOLOGY

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud

Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbents, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance.

APPENDIX B

Queen Mary's Hospital, Sidcup

PLANT NOISE EMISSIONS CALCULATIONS

	Frequency, Hz								
	63	***125***	***250***	***500***	***1k***	***2k***	***4k***	***8k***	***dB(A)***
Air Handling Unit - Noise Emissions from Air Exhaust Outlet									
Sound Power Level	71	87	81	79	77	73	68	64	82
Attenuation due to duct length (4m), dB	-2.8	-1.4	-0.7	-0.4	-0.3	-0.3	-0.3	-0.3	
Attenuation due to duct bends (2No.), dB	0	-10	-16	-8	-6	-6	-6	-6	
Correction due to duct end reflection, dB	-1	0	0	0	0	0	0	0	
Conversion to SPL@1m	-11	-11	-11	-11	-11	-11	-11	-11	
Correction due to surface reflections (1no.), dB	3	3	3	3	3	3	3	3	
Minimum attenuation provided by distance (30m), dB	-30	-30	-30	-30	-30	-30	-30	-30	
Total Noise Emissions from Air Handling Unit Air Exhaust Outlet, dB	29	38	26	32	33	29	24	20	36
Air Handling Unit - Noise Emissions from Air Supply Inlet									
Sound Power Level	54	62	60	58	45	36	22	22	57
Attenuation due to duct length (6.5m), dB	-4.2	-2.1	-1.0	-0.6	-0.4	-0.4	-0.4	-0.4	
Attenuation due to duct bends (2No.), dB	0	-10	-16	-8	-6	-6	-6	-6	
Correction due to duct end reflection, dB	-1	0	0	0	0	0	0	0	
Conversion to SPL@1m	-11	-11	-11	-11	-11	-11	-11	-11	
Correction due to surface reflections (1no.), dB	3	3	3	3	3	3	3	3	
Minimum attenuation provided by distance (30m), dB	-30	-30	-30	-30	-30	-30	-30	-30	
Total Noise Emissions from Air Handling Unit Air Supply Inlet, dB	11	12.3	5.4	11.8	1.0	-8.0	-22.0	-21.9	10
Air Handling Unit - Noise Breakout from Fan Casing Breakout									
Sound Power Level	59	66	72	66	58	46	38	29	67
Conversion to SPL@1m	-11	-11	-11	-11	-11	-11	-11	-11	
Correction due to surface reflections (3No.), dB	9	9	9	9	9	9	9	9	
Minimum attenuation provided by the plantroom envelope, dB	-5	-5	-5	-6	-6	-7	-9	-11	
Minimum attenuation provided by distance (35m), dB	-31	-31	-31	-31	-31	-31	-31	-31	
Total Noise Emissions from Air Handling Unit Casing Breakout, dB	21	28	34	28	19	6	-4	-15	29
Chillers									
#1									
Sound pressure level at 1m	65	68	68	70	68	60	55	65	76
Correction due to surface reflections (3No.), dB	9	9	9	9	9	9	9	9	
Minimum attenuation provided by the plantroom envelope, dB	-5	-5	-5	-5	-5	-6	-6	-8	
Minimum attenuation provided by distance (40m), dB	-32	-32	-32	-32	-32	-32	-32	-32	
Total Noise Emissions from Air Handling Unit Casing Breakout, dB	37	40	40	42	40	31	25	34	44
#2									
Sound pressure level at 1m	65	68	68	70	68	60	55	65	67
Correction due to surface reflections (3No.), dB	9	9	9	9	9	9	9	9	
Minimum attenuation provided by the plantroom envelope, dB	-5	-5	-5	-6	-7	-8	-10	-12	
Minimum attenuation provided by distance (40m), dB	-32	-32	-32	-32	-32	-32	-32	-32	
Total Noise Emissions from Air Handling Unit Casing Breakout, dB	37	39	39	41	38	29	21	29	42
Sound Pressure Level at Receiver due to All Units, dB	**40**	**44**	**43**	**45**	**43**	**35**	**28**	**35**	**46**
						Design Criterion			**≤46**