APPENDIX H

NOISE SURVEY

Great Ormond Street Hospital for Children
NHS Foundation Trust

NHS

Great Ormond Street Hospital Charity

UCL INSTITUTE OF CHILD HEALTH

Centre for Children's Rare Disease Research
at Great Ormond Street Hospital

Noise Impact Assessment

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Audit Sheet

Revision	Description	Date	Issued by	Reviewed by
1	Issue to team for comment	18 July 2014	AH	JCE
2	Update following comments	29 July 2014	AH	-

Contents

1.0 INTRODUCTION

New mechanical plant is to be installed as part of the proposed development of the Centre for Research into Rare Disease in Children (CRRDC) on Guilford Street in the London Borough of Camden. This report assesses the impact of the noise emissions from the mechanical plant on surrounding sensitive receptors, and the expected measures that may be required in order to meet relevant criteria.

2.0 SITE DESCRIPTION

The site location, currently occupied by a former computer centre associated with the University College, London (20 Guilford Street), is bound by Guilford Street, Millman Street and Millman Mews. During the survey period, the building was disused. The plan below details the site and measurement positions.

Figure 1 Site plan and measurement positions

Guilford Street can be considered to have moderate traffic flow, as it acts as a cut-through for traffic moving between Grays Inn Road and Southampton Row/Russell Square. The area in general comprises a mix of uses including hospital buildings, offices and residential. Millman Street and Millman Mews have lesser traffic flows than that of Guilford Street and are relatively quiet.

The nearest noise sensitive residential receptors are located on Millman Street, Millman Mews, and Guilford Street.

3.0 BACKGROUND NOISE SURVEY

A long term background noise survey has been carried out from 14th May 2013 to 16th May 2013 using a fixed location sound level meter. Additional short term measurements were taken on site on the 13th May 2013.

Light rain was present during the installation of the equipment, but this cleared to cloud later and for the duration of the survey.

From observations, there did not appear to be any plant in operation on the roof. The predominant noise sources were traffic noise from Guilford Street and plant noise from nearby commercial/hospital buildings.

A summary of the measurement results is shown below.

Table 1 Summary of measurement results

Period	Descriptor	Level (dB)
07:00-23:00	Daytime $L_{Aeq,16hr}$	60
23:00-07:00	Night-time $L_{Aeq,8hr}$	54
07:00-23:00	Lowest L_{A90}	45
00:00-24:00	Lowest L_{A90}	41

4.0 BASIS OF ASSESSMENT

4.1 London Borough of Camden Requirements

The London Borough of Camden has the following policy in place, as set out in Appendix 1 of its Replacement Unitary Development Plan (UDP):

"Table E: Noise levels from plant and machinery at which planning permission will not be granted:"

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5 dB(A) $<L_{A90}$
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive facade	Day, evening and night	0000-2400	10dB(A) $<L_{A90}$
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	10dB(A) $<L_{A90}$
Noise at 1 metre external to sensitive façade where L_{A90}	Day, evening and night	0000-2400	55dB L_{Aeq}

>60dB			

To ensure that the Local Authority requirements are met, it is proposed that the following criteria shall apply:

Table 2 Design criteria to apply at 1m from the nearest noise sensitive premises

Period	Criterion (dB $L_{Aeq,T}$)
00:00-24:00	35

Should any proposed plant emit noise that has distinct impulses (bangs, clicks, clatters, thumps), the criterion shall be reduced by a further 5 dBA.

4.2 Emergency plant

It is proposed that any M&E plant for emergency use shall be designed for testing purposes only to achieve 10 dB above the lowest measured background noise level. This is specified on the basis that plant will be tested during the day and infrequently only for short periods of time. The rating level for emergency plant at sensitive receptors is shown in Table 3.

Table 3 Emergency plant noise emission limit

Period	Measured background noise level dB (L_{A90})	Emergency plant noise rating level at façade of nearest sensitive property* ($L_{Ar,T}$)
Day	45	55

5.0 PROPOSED MECHANICAL SERVICES PLANT

5.1 General plant

The following general plant items will feature on the roof of the proposed development.

5.1.1 Roof top chillers

Three air-cooled chillers will be located to the east end of the roof.

5.1.2 Roof top plant room

An enclosed plant room will also be located at roof level on the western and central areas of the proposed building. The north wall of the plant room will be louvred, and there will be a screen located directly to the north of the louvres, meaning that the louvres will not have line-of-sight to receptors.

As per the requirements of the project design, noise levels within the roof plant room are not expected to exceed NR65.

5.2 Emergency plant

The following items of emergency plant will be installed to the development. The plant will only operate in emergency situations or to be tested as described in section 4.2.

5.2.3 Standby generator

Limiting noise levels have been provided to the electrical engineer to assist in selection of suitable equipment. These are shown in the calculations in Appendix D.

6.0 NOISE MITIGATION SCHEME

In order that noise is brought within acceptable levels at the nearby receptors, the following measures are recommended.

- 900mm long attenuators to the chiller fan discharges;
- Shrouds to all chiller compressors and lagging to all chiller pipework; and
- 600mm double bank (chevron) louvre to the roof edges.

The generator set needs to be selected to the appropriate limiting levels.

The plant within the plant room will be selected in order to maintain the project target level in that space. It is anticipated that an acoustic louvre will not be required to the external wall.

6.1 Predicted noise levels incorporating mitigation

6.2 General plant

Description	Residential at London House/Millman Mews
Predicted Noise Level $L_{Aeq,T}$ (1m from window)	**35 dB**
Acoustic Feature Correction	0 dB
Rating Level	35 dB
Minimum Background Level L_{A90}	41 dB

Description	Residential at Millman Street
Predicted Noise Level $L_{Aeq,T}$ (1m from window)	**29 dB**
Acoustic Feature Correction	0 dB
Rating Level	35 dB
Minimum Background Level L_{A90}	41 dB

6.3 Emergency plant

Description	Residential at London House/Millman Mews
Predicted Noise Level $L_{Aeq,T}$ (1m from window)	**55 dB**
Acoustic Feature Correction	0 dB
Rating Level	55 dB
Minimum Background Level L_{A90} (day only)	45 dB

7.0 CONCLUSION

Hoare Lea Acoustics have undertaken a background noise survey and plant assessment in respect of the planning application for the proposed CRRDC, Guilford Street.

Detailed calculations have been undertaken in order to predict the sound pressure level 1 meter from the nearest noise sensitive receptor. These predictions have then been assessed according to London Borough of Camden requirements of at least 6 dB below the minimum measured external background level (L_{A90}).

Emergency plant has been assessed to 10 dB greater than the prevailing daytime background noise level, on the basis that plant will be tested during daytime hours and infrequently only for short periods of time. As emergency plant has not been selected at this stage, it is proposed to limit the noise levels that will be generated by the plant.

Mitigation has been prescribed in order to maintain acceptable noise levels to neighbouring residential receptors.

The calculations have shown that the installation of the mechanical services plant and associated mitigation measures will result in a rating level that demonstrates compliance with the London Borough of Camden's requirements at the closest noise sensitive receptors.

APPENDIX A – ACOUSTIC TERMINOLOGY

Decibel (dB)

The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithm's are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Octave and Third Octave Bands

The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

A-Weighting

The 'A' weighting is a correction term applied to the frequency range in order to mimic the sensitivity of the human ear to noise. It is generally used to obtain an overall noise level from octave or third octave band frequencies. An 'A' weighted value would be written as dBA.

Equivalent Continuous Sound Pressure Level - $L_{eq,T}$

The $L_{eq,T}$ is a parameter defined as the equivalent continuous sound pressure level. Over a defined time period 'T', it is the sound pressure level equivalent to the acoustic energy of the fluctuating sound signal. The $L_{eq,T}$ can be seen to be an "average" sound pressure level over a given time period (although it is not an arithmetic average). Typically the $L_{eq,T}$ will be an 'A' weighted noise level in dB(A). It is commonly used to describe all types of environmental noise sources.

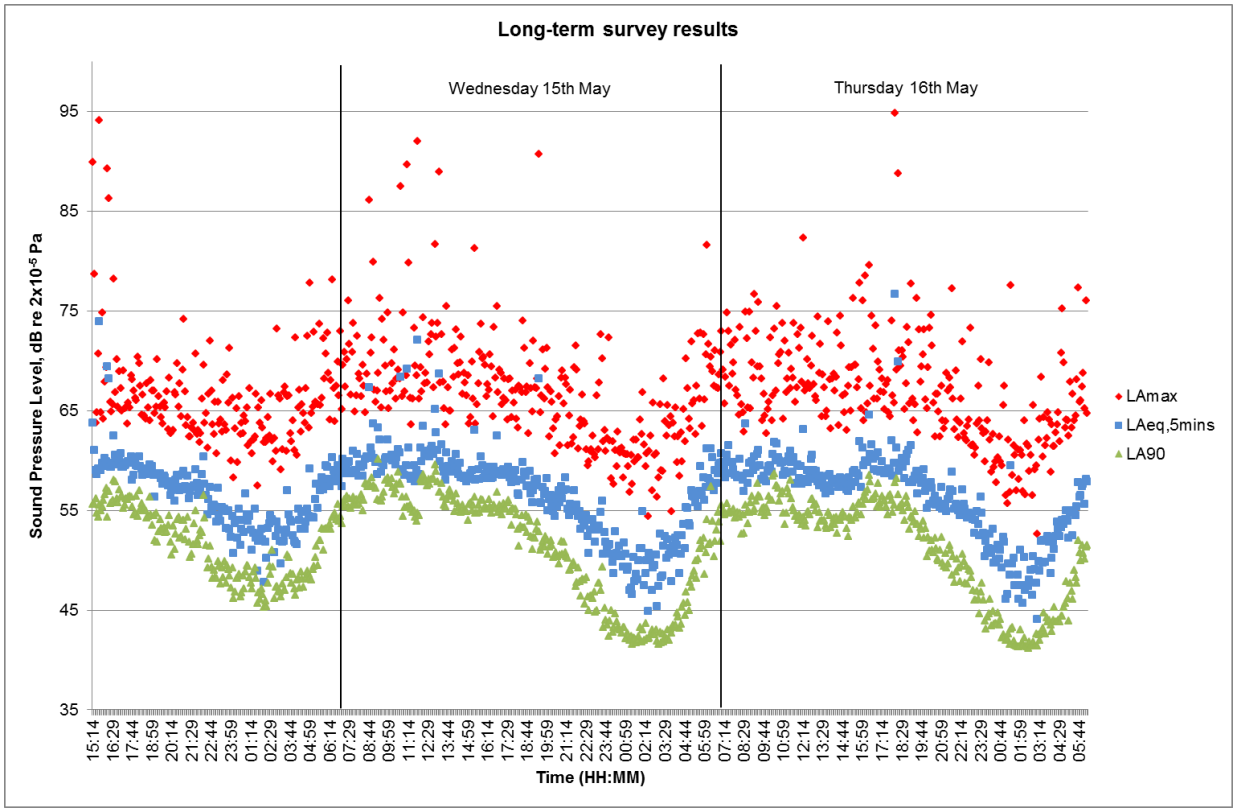
Background Noise Level - $L_{90,T}$

The $L_{90,T}$ is a parameter defined as the sound pressure level exceeded for 90% of the measurement period 'T'. It is a statistical parameter and can not be directly combined to other acoustic parameters. It is generally used to describe the prevailing background noise level or underlying noise level.

Rating level

The 'specific' noise level emitted by plant items individually or combined.

APPENDIX B – BACKGROUND NOISE SURVEY RESULT CHART



APPENDIX C – PLANT LAYOUT DRAWINGS

APPENDIX D – CALCULATED NOISE LEVELS

Chillers:

Calculation step	dB per Octave Band Centre Frequency, Hz						dB(A)	NR
	125	250	500	1000	2000	4000		
Unit sound power level, Climaveneta TECS2/XL-CA 0853 with 900mm discharge atts	81	78	71	68	66	66	84	
Tolerances to manufacturer's data	4	4	4	4	4	4		
Global directionality correction	-6	-6	-6	-6	-6	-6		
Distance attenuation (25m)	-40	-40	-40	-40	-40	-40		
Barrier loss (600mm chevron acoustic louvre)	-5	-9	-13	-22	-24	-23		
Reflections (0 off.)								
No. sources (3 off.)	5	5	5	5	5	5		
Façade correction	3	3	3	3	3	3		
Resultant sound pressure level at Millman Mews/London House*	43	37	28	18	14	12	32	27
Criteria	43	36	30	26	23	21	35	26
Excesses	*-1*	**1**	*-2*	*-8*	*-9*	*-9*	*-2*	*0*

Calculation step	dB per Octave Band Centre Frequency, Hz						dB(A)	NR
	125	250	500	1000	2000	4000		
Unit sound power level, Climaveneta TECS2/XL-CA 0853 with 900mm discharge atts	81	78	71	68	66	66	84	
Tolerances to manufacturer's data	4	4	4	4	4	4		
Global directionality correction	-6	-6	-6	-6	-6	-6		
Distance attenuation (20m)	-38	-38	-38	-38	-38	-38		
Barrier loss (Lightweight masonry)	-16	-19	-21	-24	-24	-24		
Reflections (0 off.)								
No. sources (3 off.)	5	5	5	5	5	5		
Façade correction	3	3	3	3	3	3		
Resultant sound pressure level at Millman Street*	33	28	22	18	16	13	26	20
Criteria	43	36	30	26	23	21	35	26
Excesses	*-10*	*-7*	*-8*	*-8*	*-7*	*-8*	*-9*	*-7*

Roof plant room:

Calculation step	dB per Octave Band Centre Frequency, Hz						dB(A)	NR	R_w
	125	250	500	1000	2000	4000			
Total reverberant noise level in Roof plant room	78	71	67	64	60	56	70	65	
External surface composite Sound Reduction Index (SRI)*	-2	-3	-3	-3	-3	-3			3
External surface area correction (30m²)	15	15	15	15	15	15			
Propagation correction (20m)	-26	-26	-26	-26	-26	-26			
Barrier effect from roof edge	-10	-12	-15	-17	-20	-23			
0	0	0	0	0	0	0			
Correction factor as per calculation method	-14	-14	-14	-14	-14	-14			
Façade correction	3	3	3	3	3	3			
Resultant noise level at London House	44	34	27	22	15	8	32	25	
Criteria	43	36	30	26	23	21	34	26	
Excesses	*0*	*-2*	*-3*	*-4*	*-8*	*-13*	*-2*	*-1*	
** Includes following 45° directionality losses/gains applied to louvre only*	*-4*	*-6*	*-6*	*-6*	*-6*	*-6*			

Calculation step	dB per Octave Band Centre Frequency, Hz						dB(A)	NR	R_w
	125	250	500	1000	2000	4000			
Total reverberant noise level in Roof plant room	78	71	67	64	60	56	70	65	
External surface composite Sound Reduction Index (SRI)*	-3	-3	-3	-3	-3	-3			4
External surface area correction (30m²)	15	15	15	15	15	15			
Propagation correction (30m)	-30	-30	-30	-30	-30	-30			
Barrier effect from roof edge	-10	-12	-15	-17	-20	-23			
Correction factor as per calculation method	-14	-14	-14	-14	-14	-14			
Façade correction	3	3	3	3	3	3			
Resultant noise level at Residential on Millman Street	39	30	23	18	11	4	27	20	
Criteria	43	36	30	26	23	21	34	26	
Excesses	*-4*	*-6*	*-7*	*-8*	*-12*	*-17*	*-7*	*-7*	
** Includes following 90° directionality losses/gains applied to louvre only*	*-19*	*-20*	*-20*	*-20*	*-20*	*-20*			

Emergency Generator:

Atmosphere Side Calculation Description to Development roof (Millman Mews/London House)	dBA	Noise Level per Octave Band Frequency (Hz) dB					
		125	250	500	1000	2000	4000
Generator intake/exhaust facing development roof (Lw)	90	89	84	80	82	83	84
Total System Losses	-	0	0	0	0	0	0
Grille End Reflection	-	-2	0	0	0	0	0
Distance to Receiver	-	-37	-37	-37	-37	-37	-37
Q	Grille flush with surface						
Directivity Correction (90°)	-	1	-3	-4	-9	-13	-16
Façade Correction	-	3	3	3	3	3	3
Ducted Total Receiver Level Lp	**53**	61	54	49	46	43	41
Criteria (dB(A))	**54**	61	54	49	46	43	41
Attenuation Required	-	**-**	**-**	**-**	**-**	**-**	**-**

Limiting noise level for termination facing Millman Street

Atmosphere Side Calculation Description to Residential on Millman Street	**dBA**	**Noise Level per Octave Band Frequency (Hz) dB**					
		125	**250**	**500**	**1000**	**2000**	**4000**
Generator intake/exhaust facing Millman Street, limiting levels (Lw)	72	81	70	65	61	58	57
Total System Losses	-	0	0	0	0	0	0
Grille End Reflection	-	-2	0	0	0	0	0
Distance to Receiver	-	-33	-33	-33	-33	-33	-33
Q	Grille flush with surface						
Directivity Correction (30°)	-	4	6	6	7	7	6
Façade Correction	-	3	3	3	3	3	3
Ducted Total Receiver Level Lp	**53**	60	53	48	45	42	40
Criteria (dB(A))	**54**	61	54	49	46	43	41
Attenuation Required	-	**-**	**-**	**-**	**-**	**-**	**-**

Limiting casing radiated level for containerised unit

Calculation step	dB per Octave Band Centre Frequency, Hz						dB(A)	NR
	125	250	500	1000	2000	4000		
Unit sound power level, Generator Casing Radiated Limiting Levels	94	87	82	79	76	74	86	
Tolerances to manufacturer's data	4	4	4	4	4	4		
Distance attenuation (25m)	-40	-40	-40	-40	-40	-40		
Reflections (0 off.)	0	0	0	0	0	0		
No. sources (1 off.)	0	0	0	0	0	0		
Façade correction	3	3	3	3	3	3		
Resultant sound pressure level at Millman Mews/London House*	61	54	49	46	43	41	54	46
Criteria	61	54	49	46	43	41	54	46
Excesses	0	0	0	0	0	0	0	0