

ACOUSTIC REPORT

NO CS7715/1 Revision A

**Manufacturing Pharmacy
Royal Free Hospital,
Pond Street,
London
NW3 2QG**

21st October 2015

Prepared By:

Stuart Metcalfe

Stuart Metcalfe MIOA

CLIENT:

**Royal Free Hospital NHS Foundation Trust,
Pond Street,
London
NW3 2QG**

Royal Free London



NHS Foundation Trust

Conabeare Acoustics Limited

11 Chiltern Enterprise Centre, Station Road, Theale, Berkshire. RG7 4AA
Telephone 0118 930 3650 Facsimile 0118 930 3912

sales@conabeare.co.uk

FORWARD

An environmental acoustic survey has been carried out to the North Elevation ground floor plant area of Royal Free Hospital, Pond Street, London NW3 2QG.

It is proposed that the existing Air Handling Unit will be replaced with a similar item of plant on a like for like basis.

The results of this survey will establish the Existing Plant Sound Levels to enable the new mechanical services plant to be designed to not exceed the existing plant noise levels.

SUMMARY

The lowest $L_{A90,15min}$ levels measured on the ground floor area were;

$L_{A90,15min}$ 62dB(A) between 07:00 hours to 19:00 hours.

$L_{A90,15min}$ 62dB(A) between 19:00 hours to 23:00 hours.

$L_{A90,15min}$ 62dB(A) between 23:00 hours to 07:00 hours.

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1. Author

Stuart Metcalfe MIOA

The author of this report has been practicing in building services acoustics and noise control engineering for 25 years, is a Member of the Institute of Acoustics (MIOA) and is a Director at Conabeare Acoustics Ltd.

2. Client

The report and survey has been undertaken on behalf of:

Royal Free Hospital NHS Foundation Trust,
Pond Street,
London
NW3 2QG

3. Introduction

The survey has been carried out to establish the noise level for the existing plant to ensure that the proposed plant does not have a detrimental effect on the local surroundings and in particular residential premises.

The existing plant is to be replaced on a like for like basis and we understand that there have been no complaints made regarding noise from the existing plant.

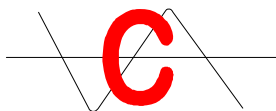
4. Noise Principles

The environmental survey has been carried out generally in accordance with the principles of BS7445-1 (2003) and BS4142 to establish the Background Sound Level

The Background Sound levels measured is in terms A-weighted sound pressure level L_{A90} with a time interval of 15 minutes.

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GLOSSARY.

LA90	The sound pressure level in dB(A) which is exceeded for 90% of the time and is taken to be the effective lowest background sound level for the period by such methods of sound rating as that recommended in British Standard 4142. It will also be used as a basis for selecting limiting sound levels from new plant by Local Planning Authorities when setting Planning Consent Conditions.
Leq	The “equivalent continuous sound level” for the measuring period, defined as the level in dB(A) which, if held constant over the measuring period, would produce the same amount of sound energy as does the actual varying ambient sound level. It is a measure of the amount of sound energy affecting the site from sources other than new plant or operations.
LA10	The sound level exceeded for 10% of the time over the sample period. Originally used as a measure of subjective reaction to traffic noise in particular, it can also be taken as an indication of the practical maximum sound level that the building envelope will have to protect against.
dB(A)	Describes 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 3dB(A) is the minimum perceptible under normal conditions, and a change of 10dB(A) corresponds roughly to halving or doubling the loudness of a sound.

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5. The Site

The site is located to the North of the Hospital facing the elevation of premises to Pond Street which contains a mixture of Health Care, Commercial and Residential premises.

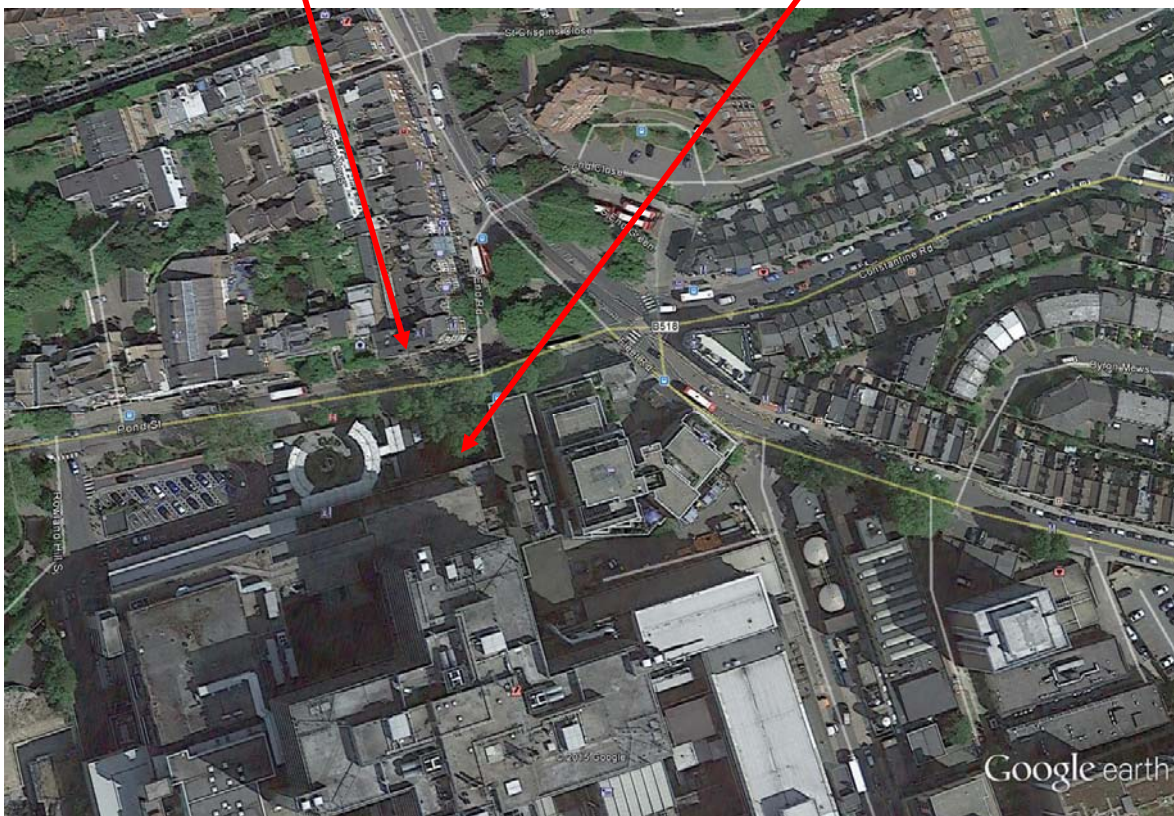
The Hospital itself is the largest building within this area and is in use on a 24 hour basis.

The nearest residential façade is at a distance of approximately 35 metres from the existing plant and approximately 5 metres higher.

The existing plant is the dominant sound source within the area at the measuring location.

Nearest Residential
Premises

Measuring
Location



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6. Measurement Methodology

A CEL593 (precision) Environmental Sound Level Analyser, fitted with a CEL Electret Microphone was located within the plant compound containing the existing plant.

The Survey commenced at approximately 08:10 hours on Friday 9th October 2015 until approximately 17:00 hours on Saturday 10th October 2015 when the battery failed. The survey completed the required 24 hour period.

The Analyser was checked for calibration before readings commenced and at the end of the measurement period using a CEL 284/2 Class 1 calibrator. There was no measurable deviation on the Analyser.

The weather was mostly dry and warm throughout the measuring period.

The weather in our opinion did not have a detrimental effect on the readings obtained.

7. Planning noise requirements.

The Planning noise requirement for the London Borough of Camden states, that any proposed plant should be at least 10dBA below the Background Sound level (L_{A90}) measured at 1 metre from the nearest affected residential property. Allowance should also be made for any tonal noise emanating from the proposed units.

London Borough of Camden Council's policies relating to noise from new mechanical services equipment are contained within the Council's Local Development Framework; Policy DP28.

In Summary, London Borough of Camden's noise conditions are:

Noise level from plant and machinery at which planning permission will not be granted:

Noise at 1m external to a sensitive façade	5dBA < L_{A90}
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1m external to a sensitive façade	10dBA < L_{A90}
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1m external to a sensitive façade	10dBA < L_{A90}
Noise at 1m external to sensitive façade where $L_{A90} > 60\text{dB}$	55dB L_{Aeq}

Table 1: London Borough of Camden Council noise related planning conditions

Each of the above is applicable over a period of 60 minutes and measured at 1m external to noise-sensitive facades (typically nearest residential windows).

This should as a matter of course be verified with the local Environmental Health or Planning Departments.

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8. Assessment

The Environmental Sound Level Analyser was located at a height of 1.8 metres above the ground level within the plant area to pick up the existing ambient noise. The microphone was located at a distance of at least 1 metre from the plant and the fence to eliminate any undue reflections.

The objective of any specification limiting new noises should therefore be to ensure that sound emission from the new building services plant and any other new sources in particular should not materially add to the existing ambient sound climate.

As to the level at which the target should be set, this is normally specified by the planning authority in their planning consent conditions.

Whilst it was not possible to establish a background level as the existing plant runs on a 24 hour basis, we have previously carried out Acoustic Surveys to this elevation of the Hospital to establish a target level.

The lowest level L_{A90} established in our Survey and Report of February 2014 was 51dBA which would then require a target L_{Aeq} level of 41dBA at 1 metre from the nearest residential façade.

The noise sensitive premises in closest proximity to the proposed facility are residential in usage and must be given particular consideration in terms of acceptable levels of noise exposure from the proposed fixed mechanical plant installation.

As the underlying noise levels from the existing plant has been established as 62-63dBA within the plant area we have calculated that the noise levels expected at the nearest residential premises from the proposed plant in would be below this target level with the mitigating measures installed as proposed below.

We have detailed below calculations on the proposed plant and would confirm that it will be necessary to install inlet and outlet attenuation to the Proposed Air Handling Unit. This attenuation should have the following Insertion Loss Figures and be similar to that detailed.

Fresh Air Inlet

	Insertion Loss (dB) at Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
Type KSD55 – 900mm Long	8	12	18	25	28	23	19	16

Exhaust

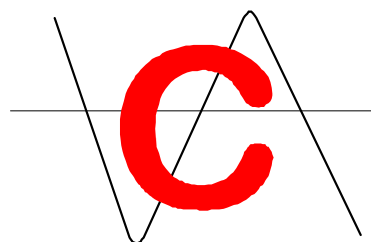
	Insertion Loss (dB) at Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
Type KSD55 – 900mm Long	8	12	18	25	28	23	19	16

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CS7715 - Royal Free Hospital, Pond Street, London NW3 2QG - Manufacturing Pharmacy

- Period result profile -



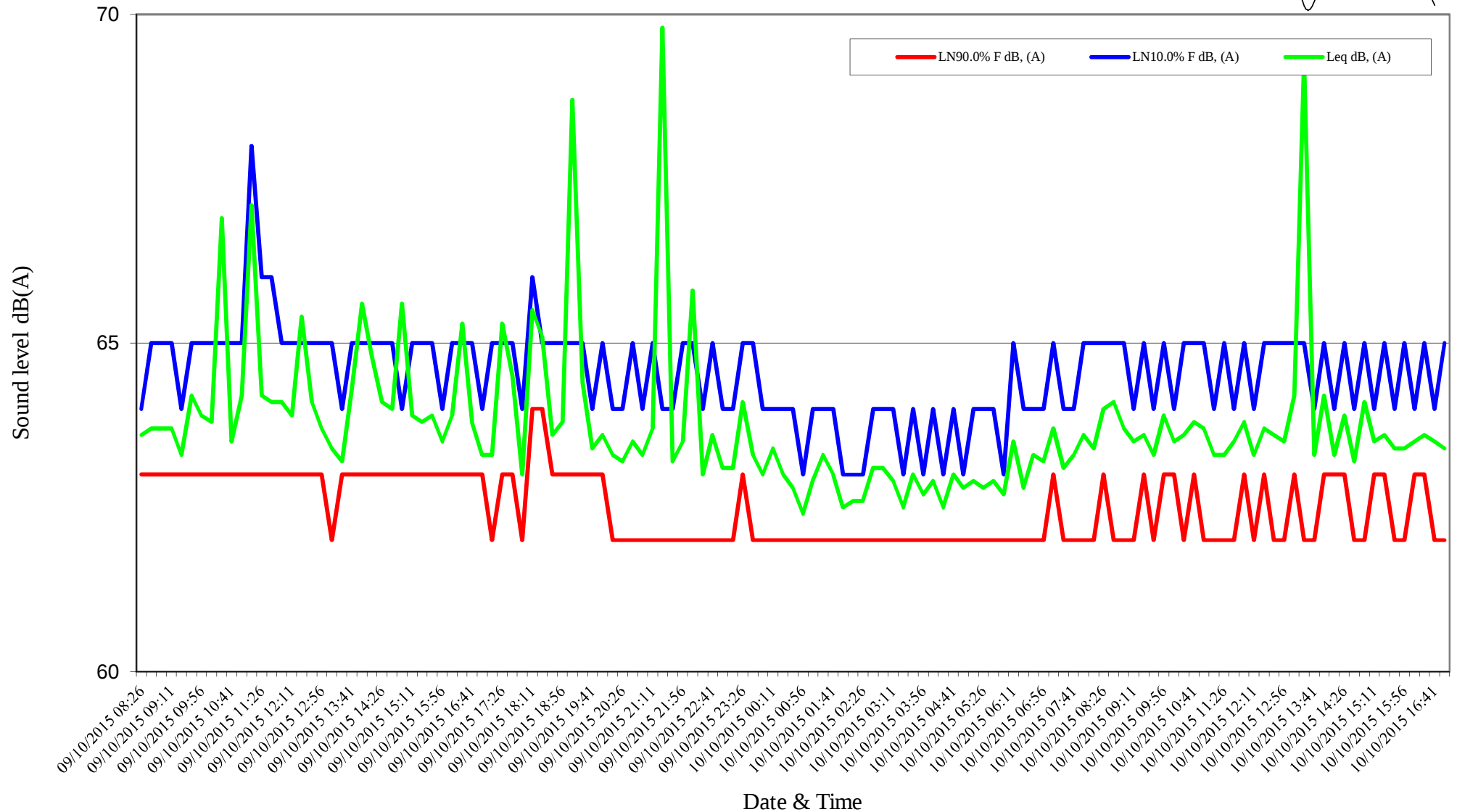
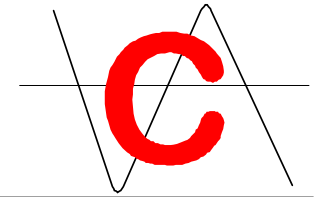
Overload occurred	Yes
Low battery occurred	Yes
Pause was used	No
Frequency weighting	A
Band	Broadband
Period time	15 min
Periods too short for LNs	No
First period listed	1 : 131

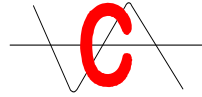
Period number	Flags	Date and Time	LN90.0% F	LN10.0% F	Leq
	OBPZ		dB, (A)	dB, (A)	dB, (A)
1	O---	09/10/2015 08:26	63	64	63.6
2	----	09/10/2015 08:41	63	65	63.7
3	----	09/10/2015 08:56	63	65	63.7
4	----	09/10/2015 09:11	63	65	63.7
5	----	09/10/2015 09:26	63	64	63.3
6	----	09/10/2015 09:41	63	65	64.2
7	----	09/10/2015 09:56	63	65	63.9
8	----	09/10/2015 10:11	63	65	63.8
9	----	09/10/2015 10:26	63	65	66.9
10	----	09/10/2015 10:41	63	65	63.5
11	----	09/10/2015 10:56	63	65	64.2
12	----	09/10/2015 11:11	63	68	67.1
13	----	09/10/2015 11:26	63	66	64.2
14	----	09/10/2015 11:41	63	66	64.1
15	----	09/10/2015 11:56	63	65	64.1
16	----	09/10/2015 12:11	63	65	63.9
17	----	09/10/2015 12:26	63	65	65.4
18	----	09/10/2015 12:41	63	65	64.1
19	----	09/10/2015 12:56	63	65	63.7
20	----	09/10/2015 13:11	62	65	63.4
21	----	09/10/2015 13:26	63	64	63.2
22	----	09/10/2015 13:41	63	65	64.3
23	----	09/10/2015 13:56	63	65	65.6
24	----	09/10/2015 14:11	63	65	64.8
25	----	09/10/2015 14:26	63	65	64.1
26	----	09/10/2015 14:41	63	65	64
27	----	09/10/2015 14:56	63	64	65.6
28	----	09/10/2015 15:11	63	65	63.9
29	----	09/10/2015 15:26	63	65	63.8
30	----	09/10/2015 15:41	63	65	63.9
31	----	09/10/2015 15:56	63	64	63.5
32	----	09/10/2015 16:11	63	65	63.9
33	----	09/10/2015 16:26	63	65	65.3
34	----	09/10/2015 16:41	63	65	63.8
35	----	09/10/2015 16:56	63	64	63.3
36	----	09/10/2015 17:11	62	65	63.3
37	----	09/10/2015 17:26	63	65	65.3
38	----	09/10/2015 17:41	63	65	64.5
39	----	09/10/2015 17:56	62	64	63
40	----	09/10/2015 18:11	64	66	65.5
41	----	09/10/2015 18:26	64	65	65.1
42	----	09/10/2015 18:41	63	65	63.6
43	----	09/10/2015 18:56	63	65	63.8
44	----	09/10/2015 19:11	63	65	68.7
45	----	09/10/2015 19:26	63	65	64.4
46	----	09/10/2015 19:41	63	64	63.4

Period number	Flags	Date and Time	LN90.0% F	LN10.0% F	Leq
	OBPZ		dB, (A)	dB, (A)	dB, (A)
47	----	09/10/2015 19:56	63	65	63.6
48	----	09/10/2015 20:11	62	64	63.3
49	----	09/10/2015 20:26	62	64	63.2
50	----	09/10/2015 20:41	62	65	63.5
51	----	09/10/2015 20:56	62	64	63.3
52	----	09/10/2015 21:11	62	65	63.7
53	O---	09/10/2015 21:26	62	64	69.8
54	----	09/10/2015 21:41	62	64	63.2
55	----	09/10/2015 21:56	62	65	63.5
56	----	09/10/2015 22:11	62	65	65.8
57	----	09/10/2015 22:26	62	64	63
58	----	09/10/2015 22:41	62	65	63.6
59	----	09/10/2015 22:56	62	64	63.1
60	O---	09/10/2015 23:11	62	64	63.1
61	----	09/10/2015 23:26	63	65	64.1
62	O---	09/10/2015 23:41	62	65	63.3
63	----	09/10/2015 23:56	62	64	63
64	----	10/10/2015 00:11	62	64	63.4
65	----	10/10/2015 00:26	62	64	63
66	----	10/10/2015 00:41	62	64	62.8
67	----	10/10/2015 00:56	62	63	62.4
68	----	10/10/2015 01:11	62	64	62.9
69	----	10/10/2015 01:26	62	64	63.3
70	----	10/10/2015 01:41	62	64	63
71	----	10/10/2015 01:56	62	63	62.5
72	----	10/10/2015 02:11	62	63	62.6
73	----	10/10/2015 02:26	62	63	62.6
74	----	10/10/2015 02:41	62	64	63.1
75	----	10/10/2015 02:56	62	64	63.1
76	----	10/10/2015 03:11	62	64	62.9
77	----	10/10/2015 03:26	62	63	62.5
78	----	10/10/2015 03:41	62	64	63
79	----	10/10/2015 03:56	62	63	62.7
80	----	10/10/2015 04:11	62	64	62.9
81	----	10/10/2015 04:26	62	63	62.5
82	----	10/10/2015 04:41	62	64	63
83	----	10/10/2015 04:56	62	63	62.8
84	----	10/10/2015 05:11	62	64	62.9
85	----	10/10/2015 05:26	62	64	62.8
86	----	10/10/2015 05:41	62	64	62.9
87	----	10/10/2015 05:56	62	63	62.7
88	----	10/10/2015 06:11	62	65	63.5
89	----	10/10/2015 06:26	62	64	62.8
90	----	10/10/2015 06:41	62	64	63.3
91	----	10/10/2015 06:56	62	64	63.2
92	----	10/10/2015 07:11	63	65	63.7
93	----	10/10/2015 07:26	62	64	63.1
94	----	10/10/2015 07:41	62	64	63.3
95	----	10/10/2015 07:56	62	65	63.6
96	----	10/10/2015 08:11	62	65	63.4
97	----	10/10/2015 08:26	63	65	64
98	----	10/10/2015 08:41	62	65	64.1
99	----	10/10/2015 08:56	62	65	63.7
100	----	10/10/2015 09:11	62	64	63.5
101	----	10/10/2015 09:26	63	65	63.6
102	----	10/10/2015 09:41	62	64	63.3
103	----	10/10/2015 09:56	63	65	63.9
104	----	10/10/2015 10:11	63	64	63.5
105	----	10/10/2015 10:26	62	65	63.6

Period number	Flags	Date and Time	LN90.0% F	LN10.0% F	Leq
	OBPZ		dB, (A)	dB, (A)	dB, (A)
106	----	10/10/2015 10:41	63	65	63.8
107	----	10/10/2015 10:56	62	65	63.7
108	----	10/10/2015 11:11	62	64	63.3
109	----	10/10/2015 11:26	62	65	63.3
110	----	10/10/2015 11:41	62	64	63.5
111	----	10/10/2015 11:56	63	65	63.8
112	----	10/10/2015 12:11	62	64	63.3
113	----	10/10/2015 12:26	63	65	63.7
114	----	10/10/2015 12:41	62	65	63.6
115	----	10/10/2015 12:56	62	65	63.5
116	----	10/10/2015 13:11	63	65	64.2
117	----	10/10/2015 13:26	62	65	69.3
118	----	10/10/2015 13:41	62	64	63.3
119	----	10/10/2015 13:56	63	65	64.2
120	----	10/10/2015 14:11	63	64	63.3
121	----	10/10/2015 14:26	63	65	63.9
122	----	10/10/2015 14:41	62	64	63.2
123	----	10/10/2015 14:56	62	65	64.1
124	----	10/10/2015 15:11	63	64	63.5
125	----	10/10/2015 15:26	63	65	63.6
126	----	10/10/2015 15:41	62	64	63.4
127	----	10/10/2015 15:56	62	65	63.4
128	----	10/10/2015 16:11	63	64	63.5
129	-B--	10/10/2015 16:26	63	65	63.6
130	-B--	10/10/2015 16:41	62	64	63.5
131	-B--	10/10/2015 16:56	62	65	63.4

CS7715 - Royal Free Hospital, Pond Street, London NW3 2QG - Manufacturing Pharmacy





Project: CS7715 - Royal Free Hospital - Manufacturing Pharmacy Project
Client : Royal Free NHS Foundation Trust
Revision: Revision C
Date : 21st October 2015

Calculation 01 - Proposed Plant Levels

1	AHU - Fresh Air Inlet		<u>63</u>	<u>125</u>	<u>250</u>	<u>500</u>	<u>1k</u>	<u>2k</u>	<u>4k</u>	<u>8k</u>	<u>dBA</u>
	Unit Lw (Manufacturers Details) - Swegon Gold RX		80	79	79	68	60	57	53	56	72
	End Reflection at Terminal		-4	0	0	0	0	0	0	0	
	Distance to Listener	1 m	-11	-11	-11	-11	-11	-11	-11	-11	
	Directivity (90 degrees)		2	2	1	0	-2	-5	-10	-15	
	Source Location (Junction)		6	6	6	6	6	6	6	6	
	Additional Surfaces	1	3	3	3	3	3	3	3	3	
	Un- Attenuated Lp at 1 metre		76	79	78	66	56	50	41	39	71
	Proposed Attenuator - Type KSD55 - 900mm Long - Insertion Loss		8	12	18	25	28	23	19	16	
	Resultant Level Lp at 1 metre		68	67	60	41	28	27	22	23	54
2	AHU - Exhaust Air		<u>63</u>	<u>125</u>	<u>250</u>	<u>500</u>	<u>1k</u>	<u>2k</u>	<u>4k</u>	<u>8k</u>	<u>dBA</u>
	Unit Lw (Manufacturers Details) - Swegon Gold RX		80	75	77	79	76	75	73	73	82
	End Reflection at Terminal		-4	0	0	0	0	0	0	0	
	Distance to Listener	1 m	-11	-11	-11	-11	-11	-11	-11	-11	
	Directivity (90 degrees)		2	2	1	0	-2	-5	-10	-15	
	Source Location (Plane)		3	3	3	3	3	3	3	3	
	Additional Surfaces	1	3	3	3	3	3	3	3	3	
	Un- Attenuated Lp at 1 metre		73	72	73	74	69	65	58	53	75
	Proposed Attenuator - Type KSD55 - 900mm Long - Insertion Loss		8	12	18	25	28	23	19	16	
	Resultant Level Lp at 1 metre		65	60	55	49	41	42	39	37	52
3	AHU - Casing Noise		<u>63</u>	<u>125</u>	<u>250</u>	<u>500</u>	<u>1k</u>	<u>2k</u>	<u>4k</u>	<u>8k</u>	<u>dBA</u>
	Unit Lw (Manufacturers Details) - Swegon Gold RX		75	67	60	64	49	48	45	48	63
	Distance to Listener	1 m	-11	-11	-11	-11	-11	-11	-11	-11	
	Additional Surfaces	1	3	3	3	3	3	3	3	3	
	Un- Attenuated Lp at 1 metre		67	59	52	56	41	40	37	40	55
	Combined Level at 1 metre - Unattenuated - Items 1, 2 and 3		72	68	62	57	44	44	41	42	59
	TARGET LEVEL - 63dBA - EXCESS = -4dBA										

Acoustic Calibration Services Limited,
Unit 6F, Diamond Industrial Centre,
Works Road, Letchworth Garden City,
Hertfordshire SG6 1LW



Tel: 01462-610085/87 Fax: 01462-610087
e-mail: cal@acousticcalibration.co.uk
web: www.acousticcalibration.co.uk

CERTIFICATE OF CALIBRATION

Model: CEL-593.C1R

Serial No: 065512

Organisation: Conabeare Acoustics Limited, 10 Chiltern Enterprise Centre
Station Road, Theale, Berkshire RG7 4AA

Job Number: 2322

Customer Order Reference: Stuart Metcalfe

The Sound Level Meter was assessed for conformance with International Standards *IEC 60651* and *IEC 60804* using test procedures described in *BS 7580* Part 1. The meter claims Type 1 accuracy conformance and it was against these requirements that all the results were evaluated.

The sound level meter was fitted with a CEL 250 measurement microphone Serial No. 1297 and a CEL-527 preamplifier Serial No. 065542. The microphone has a nominal capacitance of 18 pF and the device used to apply electrical signals to the preamplifier was of the same nominal capacitance.

A CEL-284/2 Acoustic Calibrator Serial No: 0527682 was utilised in establishing the initial acoustic calibration setting.

The sound level meter passed all applied tests with no deviations from Type 1 specification, in accordance with *IEC 60651* and *IEC 60804*. Accordingly, the meter meets the requirements of *BS 7580* Part 1.

The sound level meter should be set to read 114.0dB when used with the associated acoustic calibrator, microphone and preamplifier as detailed above at reference atmospheric pressure.

All ACSL's calibration instrumentation is fully traceable to National Standards. The acoustic references are calibrated by laboratories which are UKAS accredited for the purpose.

Certificate No: 14602

Date of Issue: 11th October 2014

Signature:

Print Name:

Trevor Lewis

Registered Office: HW Associates, Portmill Lane, Hitchin, Hertfordshire SG5 1DJ Registered No: 4143457 VAT No: GB 770505441
Directors: Trevor J Lewis, Owen R Clingan MIOA

Acoustic Calibration Services Limited,
Unit 6F, Diamond Industrial Centre,
Works Road, Letchworth Garden City,
Hertfordshire SG6 1LW



Tel: 01462-610085/87 Fax: 01462-610087
e-mail: cal@acousticcalibration.co.uk
web: www.acousticcalibration.co.uk

CERTIFICATE OF CALIBRATION

Model: CEL-284/2

Serial Number: 0527682

Organisation: Conabeare Acoustics Limited, 10 Chilton Enterprise Centre
Station Road, Theale, Berkshire RG7 4AA

Job Number: 2322

Customer Order Reference: Stuart Metcalfe

The acoustic calibrator was run for a period of time until a stable level was measured. The output level was compared to the certified level of the laboratory measurement references. The measurements were repeated 5 times and the average value calculated.

The ambient temperature during calibration was $24.0 \pm 1^{\circ}\text{C}$.

The barometric pressure was 101.1 to 101.2 kPa.

The relative humidity was 49 to 59 %

The output of the acoustic calibrator when applied to the CEL 250 is 114.0dB when corrected to the standard atmospheric pressure of 101.3kPa.

The signal output frequency of the acoustic calibrator operates at 1000Hz.

All ACSL's calibration instrumentation is fully traceable to National Standards. The acoustic references are calibrated by laboratories which are UKAS accredited for the purpose.

Certificate No: 14601

Date of Issue: 11th October 2014

Signature:

Print Name:

Trevor Lewis

Registered Office: HW Associates, Portmill Lane, Hitchin, Hertfordshire SG5 1DJ Registered No: 4143457 VAT No: GB 770505441

Directors: Trevor J Lewis, Owen R Clingan MIOA