

ACOUSTICS

## ENVIRONMENTAL ACOUSTIC IMPACT ASSESSMENT

The Royal Free NHS Trust Pond Street Hampstead London NW3 2QG

East 12B Roof

Reference : CS8419-01 Revision : Revision A Status : Planning Issue Issue Date : 21<sup>st</sup> July 2021

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**CLIENT:** 

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# ANSELL+BAILEY



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## ACOUSTICS

### **1** Introduction

Conabeare Acoustics Limited have been commissioned by Ansell & Bailey Limited to undertake an Acoustic Survey and BS4142:2014 assessment in relation to noise emissions of proposed plant at The Royal Free London Hospital, Pond Street, Hampstead, London NW3 2QG for planning purposes.

The Survey was undertaken by Stuart Metcalfe MIOA who has been practicing in Building Services Acoustics and Noise Control Engineering for in excess of 30 years, is a Member of the Institute of Acoustics (MIOA) and is a Director at Conabeare Acoustics Ltd.

## 2 Acoustic Criteria

#### BS4142:2014 Methods for rating and assessing industrial and commercial sound.

BS4142:2014 gives a method for rating sound from industrial and commercial sources affecting people inside or outside dwellings or premises used for residential purposes.

An initial estimate of the significance of the sound from the industrial/commercial nature can be assessed by subtracting the measured background noise level from the rating level (this is the specific sound level of the source with any corrections or penalties for distinctive acoustic characteristics).

Typically, the greater the difference, the greater the magnitude of the impact.

The site is located within the London Borough of Camden demise which has adopted the National Planning Policy Guidelines and as such References and evaluations are to be made to the National Planning Policy Framework 2012 (NPPF) and the Noise Policy Statement for England 2010 (NPSE).

There are several key phrases within the NPSE aims and these are discussed below. "Significant adverse" and "adverse"

 $NOEL - No \ Observed \ Effect \ Level$  - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

*LOAEL* – *Lowest Observed Adverse Effect Level* - This is the level above which adverse effects on health and quality of life can be detected. Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

*SOAEL* – *Significant Observed Adverse Effect Level* - This is the level above which significant adverse effects on health and quality of life occur.



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This Camden requirement for noise exposure are detailed in the Local Plan Appendix 3: Noise thresholds which is reproduced thus;

#### **Industrial and Commercial Noise Sources**

A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion).

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and Outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dB <sub>LAmax</sub>	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB LAmax	'Rating level' greater than 5dB above background and/or events exceeding 88dB <sub>LAmax</sub>

**Table C:** *Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)* 

\*10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.

\*\*levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.

The periods in Table C correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night. The Council will take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration.



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# There are certain smaller pieces of equipment on commercial premises, such as extract ventilation, air conditioning units and condensers, where achievement of the rating levels (ordinarily determined by a BS:4142 assessment) may not afford the necessary protection. In these cases, the Council will generally also require a NR curve specification of NR35 or below, dependant on the room (based upon measured or predicted Leq,5mins noise levels in octave bands) 1 metre from the façade of affected premises, where the noise sensitive premise is located in a quiet background area.



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## 3 Plant Location and Measurement Position

The site is located on Pond Street in the Hampstead District in North West London.

The site is bordered by Pond Street to the North, Fleet Road to the East, Aspern Grove to the South and the A502 Haverstock Hill to the West.

The closest sound sensitive façades are as below;

- 1. The top floor properties in The Panoramic Development at the junction of Fleet Road and Pond Street which are approximately 40 metres from the proposed plant location with screening from the building edge.
- 2. The properties in Anne Bryans House which are approximately 100 metres from the proposed plant location with screening from the building edge.
- 3. The properties to the rear of Aspern Grove which are approximately 130 metres from the proposed plant location with line of sight screening from the building edge.

#### Fig. 1 - View of Property Looking South



**Sound Sensitive Façade 3** 

Sound Sensitive Façade 2



Fig 2 – Measuring Location looking towards Proposed Plant Location



Fig 3 –Sound Sensitive Façade at Panoramic Development



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Fig 4 –Sound Sensitive Façade at Anne Bryans House



Fig 5- Proposed Plant Location looking towards Measuring Location





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## 4 Existing Noise Climate

The area is generally a mixture of commercial, healthcare and residential premises with plant noise from the area being adjudged to be the dominant background noise source during the survey period.

The survey was located in a position away from other sound sources and is deemed to be representative of the background noise levels in the area despite being fairly consistent in nature.

#### 5 Noise Survey

#### 5.1 Measurements

The Survey commenced at approximately 09:00 hours on Thursday 27<sup>th</sup> May 2021 until approximately 09:30 hours on Friday 28<sup>th</sup> May 2021.

The Analyser was programmed to record 15 minute sampling periods over the survey duration.

The microphone was located on a balustrade at approximately 1.2 metres above a reflecting plane.

The measurements and their interpretation are in accordance with BS 7445: Parts 1 and 2. All readings are Sound Pressure Levels (Lp) in dB (re  $20\mu$ Pa).

#### 5.2 Weather during Survey Period

The weather was warm and mostly dry throughout the measuring period. The weather did not, in our opinion, adversely influence the readings obtained.

#### **5.3 Instrumentation**

The instrumentation used were Type 1 Larson Davis LxT Sound Expert Sound Level Analyser confirming to IEC 651-1979 Type 1, EN60651 Type 1 and IEC 804-1985 Type 1, EN60804 Type 1.

- Larson Davis LxT Sound Level Analyser, Serial Number 0001152.
- Larson Davis PRMLxT1L Preamplifier, Serial Number 0365.
- Larson Davis LxT Sound Level Analyser, Serial Number 0003986.
- Larson Davis PRMLxT1L Preamplifier, Serial Number 036839.

The Sound Analyser and Preamplifier were calibrated on 11<sup>th</sup> March 2020, Certificate Number 34492 and 27<sup>th</sup> August 2020, Certificate Number 34911 respectively.





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The additional following equipment was also used

- Larson Davis type CAL200 Calibrator, Serial Number 17720 calibrated on 19<sup>th</sup> February 2020, Certificate Number 2020002312.
- Extension Cables

Field calibration checks were made using the Calibrator and no significant drift was noted against the Calibration level of 114.0dB  $\pm$  0.2dB at 1000Hz  $\pm$  0.2%.

#### **5.4 Survey Results**

The following is a summary of the underlying Plant Noise Levels (L<sub>Aeq</sub>) levels recorded in Daytime, Evening and Night-time Periods

- $L_{Aeq,15min}$  57.0dB(A) between 07:00 hours to 19:00 hours.
- $L_{Aeq,15min}$  56.5dB(A) between 19:00 hours to 23:00 hours.
- $L_{Aeq,15min}$  56.0dB(A) between 23:00 hours to 07:00 hours.

## 6 Assessment Methodology: BS4142:2014

A revision of British Standard BS 4142 was published at the end of October 2014 and replaces the previous 1997 edition. The main aim of the standard is to provide an assessment and rating method that is proportionate, sufficiently flexible and suitable for use by practitioners to inform professional judgement. The foreword to the standard clearly states that:

"The execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced."

It does this by providing a method for the determination of:

- rating levels for sources of an industrial and/or commercial nature; and
- ambient, background and residual sound levels.

An assessment framework is provided to allow the practitioner to use the rating, ambient, background and residual sound levels determined using the standard for the purposes of:

1) investigating complaints;

2) assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and

3) assessing sound at proposed new dwellings or premises used for residential purposes.



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The scope of the standard has now been widened to rating and assessing:

a) sound from industrial and manufacturing processes;

*b)* sound from fixed installations which comprise mechanical and electrical plant and equipment;

c) sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and

d) sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site."

It can also be seen from above that the standard explicitly states that it can be used to investigate complaints and has been significantly widened to cover not only new, modified or additional sources of sound, but also the assessment of sound affecting new dwellings or premises to be used for residential purposes.

Like the 1997 edition, the standard provides a method for correcting the specific sound levels so as to account for acoustic features that are present at the assessment location.

The approach in the 1997 edition was purely subjective and allowed for a +5 dB correction irrespective of how prominent the feature was or whether there was one feature only or a combination of tones, impulses or other features irregular enough to attract attention. The 2014 edition provides for scaled corrections up to +6 dB for tones and up to +9 dB for impulses, depending upon the prominence of the tones or impulses, as well as +3 dB corrections for:

- other sound characteristics that are neither tonal nor impulsive; and/or
- intermittent features when the sound has identifiable on/off conditions.

The corrections for tones and impulses can be assessed using subjective or reference methods. There is also an objective method for tones, which is based upon the prominence of sound pressure levels in the one-third-octave-band containing a tone in comparison to the sound pressure levels in the adjacent one-third-octave-bands.

The objective method however, does not allow for different corrections to be applied for tones differing in prominence as it only allows for a single correction of +6 dB for clearly prominent tones.

The 1997 edition assessed the likelihood of complaints using the difference between the rating level and the background sound level. A difference of around +10 dB or more indicated complaints are likely, a difference of around +5 dB was of marginal significance and a difference of more than 10 dB below the background was considered to provide a positive indication that complaints were unlikely.



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The 2014 edition no longer assesses the likelihood of complaints. Instead, it can be used to assess adverse impacts.

This change was introduced because the likelihood of complaints is not a particularly appropriate benchmark, especially when it is used in a planning context, and it also aligns the standard more closely with the type of language and benchmarks that are suitable for the assessment of sound at the planning stage for new proposed development.

It continues to use the difference between the rating level and the background sound level, though it also introduces the requirement to consider the context and states that:

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around  $+10 \, dB$  or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

The context includes consideration of pertinent factors, such as:

- the absolute level of sound;
- the character and level of the residual sound compared to the character and level of the specific sound;
- the sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.



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### 7 Noise Assessment

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 sound climate.

The background levels measured are representative of those at the nearest sound sensitive façade.

We understand that the operating hours for the plant will be on a 24 hour basis and as such we would recommend setting a target level at the nearest residential sound sensitive façade as below;

 $L_{Aeq,15min}$  46dB(A) – 24 hours.

This level is 10dB(A) below the measured background level and would provide NOEL – No Observed Effect Level - this is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

The proposed plant being assessed is as detailed below;

•	Air Handling Unit 01	- 1 number - M&Y Ventilation
•	Condensing Unit 01	- 1 number – M&Y Ventilation

• Air Handling Unit 02 - 1 number - M&Y Ventilation

We have detailed the noise levels for the above equipment, to the nearest sound sensitive façade, as well as the proposed mitigating measures, within our calculation sheet below.

#### **Acoustic Feature Correction**

We have allowed for a 3dB Acoustic Correction Feature for the sound sensitive façade.

No allowance has been made for tonal or intermittent noise as no items of plant are considered to be tonal or intermittent in nature.

#### **Distance Attenuation**

The distance loss figures are shown on our calculation sheet.

#### **Barrier Attenuation**

There is some screening afforded by the building edge and this is detailed within our calculations.



#### **Un-mitigated Noise Levels**

The combined noise level for all items of plant with no mitigating measures, and with all suitable allowances made, will be as below;

#### Location 1 – The Panoramic Development – 38dB<sub>LAeq</sub>

These combined noise levels are 18dBA <u>below</u> the measured Background Level at the nearest noise sensitive façade and will provide *NOEL – No Observed Effect Level* 

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

#### Location 2 – Anne Bryans House – 33dB<sub>LAeq</sub>

These combined noise levels are 23dBA <u>**below**</u> the measured Background Level at the nearest noise sensitive façade and will provide *NOEL – No Observed Effect Level* 

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

#### Location 3 – Aspern Grove – 40dB<sub>LAeq</sub>

These combined noise levels are 16dBA <u>below</u> the measured Background Level at the nearest noise sensitive façade and will provide *NOEL – No Observed Effect Level* 

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

Our attached calculation sheet details the plant item noise levels to each potential noise sensitive façade and in all cases these are more than 10dBA below the measured background level.

As such the resultant noise level with the mitigating measures installed can be categorised as having NOEL - No Observed Effect Level and is therefore a GREEN rating in line with Camden Council guidelines.

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.



## 8 Recommendations

As the calculated noise level from the Plant at the Sound Sensitive Façades is below the Target Level we would not make any recommendations for mitigating measures at this time.



### 9 Conclusion

A background Noise Survey was carried during a typical day and night-time period at a location representative of the nearest sound sensitive receivers.

An assessment has been carried out.

The assessment would indicate that the plant with no mitigating measures will have a GREEN rating of NOEL - No Observed Effect Level as it is more than 10dBA below the measured background level.

In our opinion, the scheme should be acceptable to the Local Authority.

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<ul> <li>Period result profile -</li> </ul>	
Overload occurred	No
Low battery occurred	No
Pause was used	No
Frequency weighting	A
Band	Broadband
Period time	15 min
Periods too short for LNs	No
First period listed	1 : 97
Measurement Description	
Start	27/05/2021 9:05:24
Stop	28/05/2021 9:26:55
Duration	24:21:31
Run Time	24:21:31
Pause	0:00:00.0
Pre Calibration	27/05/2021 8:57:15



Period number	Date	Time	LN90.0% F	LN10.0% F	Leq
			dB, (A)	dB, (A)	dB, (A)
1	27/05/2021	09:05:24	57.0	60.0	58.8
2	27/05/2021	09:20:24	57.0	59.5	58.3
3	27/05/2021	09:35:24	57.0	60.0	59.4
4	27/05/2021	09:50:24	57.5	58.5	58.2
5	27/05/2021	10:05:24	57.0	59.5	58.6
6	27/05/2021	10:20:24	57.0	59.0	58.3
7	27/05/2021	10:35:24	57.5	60.0	59.6
8	27/05/2021	10:50:24	57.0	59.0	58.9
9	27/05/2021	11:05:24	57.0	59.0	58.5
10	27/05/2021	11:20:24	57.0	60.0	59.8
11	27/05/2021	11:35:24	57.5	59.5	58.8
12	27/05/2021	11:50:24	57.0	58.5	58.2
13	27/05/2021	12:05:24	57.0	58.5	58.1
14	27/05/2021	12:20:24	57.0	58.5	57.9
15	27/05/2021	12:35:24	57.0	58.0	57.6
16	27/05/2021	12:50:24	57.0	58.5	57.9
17	27/05/2021	13:05:24	57.0	59.0	58.2
18	27/05/2021	13:20:24	57.5	59.5	58.8
19	27/05/2021	13:35:24	57.5	59.0	58.5
20	27/05/2021	13:50:24	57.5	59.5	58.6
21	27/05/2021	14:05:24	57.5	59.0	58.6
22	27/05/2021	14:20:24	57.0	60.0	58.8
23	27/05/2021	14:35:24	57.5	58.5	59.7
24	27/05/2021	14:50:24	57.0	58.5	58.1
25	27/05/2021	15:05:24	57.5	58.5	58.1
26	27/05/2021	15:20:24	57.0	58.5	57.8
27	27/05/2021	15:35:24	57.0	58.5	57.8
28	27/05/2021	15:50:24	57.5	59.0	58.9
29	27/05/2021	16:05:24	57.0	58.5	60.6
30	27/05/2021	16:20:24	57.0	58.5	58.3
31	27/05/2021	16:35:24	57.0	58.0	57.6
32	27/05/2021	16:50:24	57.5	58.5	58.3
33	27/05/2021	17:05:24	57.0	58.0	57.8
34	27/05/2021	17:20:24	57.5	59.0	59.2
35	27/05/2021	17:35:24	57.5	58.5	58.3
36	27/05/2021	17:50:24	57.5	58.5	57.9
37	27/05/2021	18:05:24	57.0	58.5	57.9
38	27/05/2021	18:20:24	57.0	58.5	59.0
39	27/05/2021	18:35:24	57.5	58.5	58.3
40	27/05/2021	18:50:24	57.0	59.0	59.0
41	27/05/2021	19:05:24	57.0	58.5	58.8

Period number	Date	Time	LN90.0% F	LN10.0% F	Leg
			dB, (A)	dB, (A)	dB, (A)
42	27/05/2021	19:20:24	57.5	59.5	59.3
43	27/05/2021	19:35:24	57.5	59.0	58.7
44	27/05/2021	19:50:24	57.0	58.5	58.5
45	27/05/2021	20:05:24	57.5	58.5	58.4
46	27/05/2021	20:20:24	57.5	58.5	58.6
47	27/05/2021	20:35:24	57.5	58.5	58.8
48	27/05/2021	20:50:24	57.5	58.5	58.3
49	27/05/2021	21:05:24	57.0	58.5	58.3
50	27/05/2021	21.00.24	57.5	59.5	58.4
51	27/05/2021	21:25:24	57.5	58.5	50.4 50.6
52	27/05/2021	21:50:24	57.5	58.5	58.2
53	27/05/2021	22:05:24	57.0	58.5	58.2
54	27/05/2021	22:00:24	56.5	58.0	57.6
55	27/05/2021	22.20.24	56.5	58.0	57.6
56	27/05/2021	22:55.24	57.0	58.0	57.6
57	27/05/2021	22:00:24	56.5	58.0	57.0
59	27/05/2021	23.03.24	57.0	58.0	57.0
50	27/05/2021	23.20.24	56.5	58.0	57.9
60	27/05/2021	23.33.24	50.5	50.0	57.2
61	27/05/2021	23.30.24	50.5	50.0	57.6
60 60	20/00/2021	00.00.24	50.5	50.0	57.0
62	28/05/2021	00:20:24	57.0	58.U	57.5
03	28/05/2021	00.55.24	30.3 50.5	57.5	57.5
04	28/05/2021	00:30:24	50.5	58.U	57.0
60	28/05/2021	01:00:24	50.0	57.5	57.Z
00	28/05/2021	01:20:24	56.0	57.0	50.8
69	28/05/2021	01:55:24	50.0	58.U	57.1
68	28/05/2021	01:50:24	57.0	58.0	57.3
69	28/05/2021	02:00:24	50.5	57.5	57.3
70	28/05/2021	02:20:24	50.U	57.5 59.0	50.9
71	28/05/2021	02:35:24	50.5	58.0	57.5
12	28/05/2021	02:50:24	56.5	58.0	57.5
73	28/05/2021	03:05:24	56.5	57.5	57.2
74	28/05/2021	03:20:24	56.0	58.0	57.1
/5	28/05/2021	03:35:24	57.0	57.5	57.3
/6	28/05/2021	03:50:24	57.0	57.5	57.3
11	28/05/2021	04:05:24	56.5	58.0	57.3
/8	28/05/2021	04:20:24	56.5	58.0	57.4
79	28/05/2021	04:35:24	56.5	57.5	57.3
80	28/05/2021	04:50:24	57.0	58.0	57.0
61	28/05/2021	05:05:24	50.5	57.5	57.1
82	28/05/2021	05:20:24	56.0	57.0	50.8
83	28/05/2021	05:35:24	56.5	58.0	57.4
84	28/05/2021	05:50:24	57.0	58.5	57.8
85	28/05/2021	00:05:24	57.0	58.0	57.7
00	28/05/2021	00:20:24	57.0	08.0 50.5	57.7
87	28/05/2021	00:35:24	57.0	58.5	58.0
88	28/05/2021	00:50:24	57.5	58.5	58.1
89	28/05/2021	07:05:24	57.5	59.0	58.3
90	28/05/2021	07:20:24	57.5	59.0	59.0
91	28/05/2021	07:55:24	57.0	59.0	08.0 50.4
92	20/05/2021	07:50:24	57.5	30.5	00.1
93	28/05/2021	08:05:24	57.5	61.0	60.7
94	28/05/2021	08:20:24	57.5	60.0	58.6
95	28/05/2021	08:35:24	57.5	59.5	58.6
90	28/05/2021	08:50:24	57.0	58.5	58.1
97	28/05/2021	09:05:24	57.0	58.5	58.0
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27th May 2021 to 28th May 2021 - Time

Sound Level dB(A)

CONABEARE -



## - ACOUSTICS

## **Glossary of Terms**

L <sub>A90</sub>	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 BS4142:2014. 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.
L <sub>Aeq</sub>	The "equivalent continuous sound level" for the measuring period, defined as the level in dBA 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.
L <sub>A10</sub>	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.
dBA	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 dBA broadly agree with people's assessment of loudness. A change of 3dBA is the minimum perceptible under normal conditions, and a change of 10dBA corresponds roughly to halving or doubling the loudness of a sound.



Project: CS8419 - 12 East B, Royal Free Hospital, Pond Street, Hampstead, London NW3 2QG Client : Ansell & Bailey Limited Revision: Revision A Date : 17th June 2021

Item

#### Calculation 01 - Noise To Panoramic Development, Pond Street - Proposed Plant - Target Level - 46dBA

AHU01 - Fresh Air	· Air Handling Unit AHU01 - Fresh Air Intake - Atmospheric Noise			63	125	250	500	1k	2k	4k	8k	dBA
							-0	-0	-0			
	Supply Fan Lw - Manufacturers Figures			76	74	89	79	79	78	76	83	87
	End Reflection			-3	0	0	0	0	0	0	0	
	Distance to Listener	40	m	-44	-44	-44	-44	-44	-44	-44	-44	
	Directivity (135 Degrees)			1	-1	-2	-5	-10	-15	-18	-21	
	Source Location (Plane)			3	3	3	3	3	3	3	3	
	Screening - Building Edge			-8	-10	-13	-15	-18	-18	-18	-18	
	Façade Effect			3	3	3	3	3	3	3	3	
	Estimated Lp at Listener AHU Fresh Air Intake Only			28	25	36	21	13	7	2	6	28
AHU02 - Exhaust	Air Handling Unit AHU02 - Exhaust - Atmospheric Noise			63	125	250	500	1k	2k	4k	8k	dBA
	Exhaust Fan Lw - Manufacturers Figures			71	83	80	82	81	75	71	67	85
	End Reflection			-3	0	0	0	0	0	0	0	
	Distance to Listener	58	m	-47	-47	-47	-47	-47	-47	-47	-47	
	Directivity (135 Degrees)			1	-1	-2	-5	-10	-15	-18	-21	
	Source Location (Free Field)			0	0	0	0	0	0	0	0	
	Screening - Building Edge			-8	-10	-13	-15	-18	-18	-18	-18	
	Facade Effect			3	3	3	3	3	3	3	3	
	Estimated Lp at Listener AHU Exhaust Only			17	28	21	18	9	-2	-9	-16	19
CU01	CU01 - Atmospheric Noise			63	125	250	500	1k	2k	4k	8k	dBA
	Unit I.w Condensing Unit - Manufacturers Data			96	95	87	86	81	77	71	69	88
	Additional Sources 3 units			5	5	5	5	5	5	5	5	00
	Distance to Listener	40		3	44	44	44	3	3	44	44	
	Sereening Duilding Edge	40	m	-44	10	12	-44	10	10	10	10	
	Screening - Bunding Euge			-0	-10	-15	-15	-10	-10	-10	-10	
				5	5	20	3	27	22	5	3	25
	Estimated Ep at Listener CUUI Uniy			52	49	38	35	21	23	1/	15	3/
	Cumulative Noise Level - Plant Noise only			52	49	40	35	27	23	17	16	38

Target Level 46dBA

#### Calculation 02 - Noise To Anne Bryans House - Proposed Plant - Target Level - 46dBA

AHU01 - Fresh Air	Air Handling Unit AHU01 - Fresh Air Intake - Atmospheric Noise			63	125	250	500	1k	2k	4k	8k	dBA
	Supply Fan Lw - Manufacturers Figures			76	74	89	79	79	78	76	83	87
	End Reflection			-3	0	0	0	0	0	0	0	
	Distance to Listener	100	m	-51	-51	-51	-51	-51	-51	-51	-51	
	Directivity (90 Degrees)			2	2	1	0	-2	-5	-10	-15	
	Source Location (Plane)			3	3	3	3	3	3	3	3	
	Screening - Building Edge			-8	-10	-13	-15	-18	-18	-18	-18	
	Facade Effect			3	3	3	3	3	3	3	3	
	Estimated Lp at Listener AHU Fresh Air Intake Only			22	21	32	19	14	10	3	5	25
AIIII02 Eachanat	Ale Handling Half ATHIO2 Fabrant Admonthesis Naise			0	125	250	500	11.	21.	41.	01.	A DL
AHU02 - Exnaust	Air Handling Unit AHU02 - Exnaust - Atmospheric Noise			63	125	250	500	IK	2K	4K	ðK	đВА
	Exhaust Fan Lw - Manufacturers Figures			71	83	80	82	81	75	71	67	85
	End Reflection			-3	0	0	0	0	0	0	0	
	Distance to Listener	125	m	-53	-53	-53	-53	-53	-53	-53	-53	
	Directivity (90 Degrees)			2	2	1	0	-2	-5	-10	-15	
	Source Location (Free Field)			0	0	0	0	0	0	0	0	
	Screening - Line of Sight			-5	-5	-5	-5	-5	-5	-5	-5	
	Façade Effect			3	3	3	3	3	3	3	3	
	Estimated Lp at Listener AHU Exhaust Only			15	30	26	27	24	15	6	-3	28
CU01	CU01 - Atmospheric Noise			63	125	250	500	1k	2k	4k	8k	dBA
	Unit Lw - Condensing Unit - Manufacturers Data			96	95	87	86	81	77	71	69	88
	Additional Sources - 3 units			5	5	5	5	5	5	5	5	
	Distance to Listener	95	m	-51	-51	-51	-51	-51	-51	-51	-51	
	Screening - Building Edge			-8	-10	-13	-15	-18	-18	-18	-18	
	Façade Effect			3	3	3	3	3	3	3	3	
	Estimated Lp at Listener CU01 Only			45	42	31	28	20	16	10	8	30
	Cumulative Noise Level - Plant Noise only			45	42	35	31	26	19	12	10	33

Target Level 46dBA

Item

Item	Calculation 03 - Noise To Aspern Grove - Proposed Plant - Target Level - 46dBA										
AHU01 - Fresh Air	Air Handling Unit AHU01 - Fresh Air Intake - Atmospheric Noise		63	125	250	500	1k	2k	4k	8k	dBA
	C. L.F. I. M. C. (		76	74	00	70	70	70	74	02	07
	Supply Fan Lw - Manufacturers Figures		/6	/4	89	/9	/9	/8	/6	83	8/
	End Kellection	120	-5	54	54	54	54	54	54	54	
	Distance to Listener	130 m	ı -54	-54	-54	-54	-54	-54	-54	-54	
	Servers Leasting (Plane)		4	2	2	2	2	2	2	1	
	Source Location (Plane)		5	5	5	5	5	5	5	5	
	Screening - Line of Signt		-5	-5	-5	-5	-5	-5	-5	-5	
			3	3	3	3	3	3	3	3	26
	Estimated Lp at Listener AHU Fresh Air Intake Only		24	24	39	29	28	27	25	31	36
AIIII02 Enhand	Ain Handling Hait A HUO2 Fakanat Atmospheric Nain		0	125	250	500	11.	21.	4.	01.	JD A
AHU02 - Exhaust	Air Handling Unit AHUUZ - Exnaust - Atmospheric Noise		03	125	250	500	IK	2K	4K	δК	UBA
	Exhaust Fan Lw - Manufacturers Figures		71	83	80	82	81	75	71	67	85
	End Reflection		-3	0	0	0	0	0	0	0	
	Distance to Listener	135 m	-54	-54	-54	-54	-54	-54	-54	-54	
	Directivity (90 Degrees)		2	2	1	0	-2	-5	-10	-15	
	Source Location (Free Field)		0	0	0	õ	0	0	0	0	
	Screening - None		0	0	0	0	0	0	0	0	
	Facade Effect		3	3	3	3	3	3	3	3	
	Estimated Lp at Listener AHU Exhaust Only		19	34	30	31	28	19	10	1	32
										-	
CU01	CU01 - Atmospheric Noise		63	125	250	500	1k	2k	4k	8k	dBA
	•										
	Unit Lw - Condensing Unit - Manufacturers Data		96	95	87	86	81	77	71	69	88
	Additional Sources - 3 units		5	5	5	5	5	5	5	5	
	Distance to Listener	130 n	-54	-54	-54	-54	-54	-54	-54	-54	
	Screening - Line of Sight		-5	-5	-5	-5	-5	-5	-5	-5	
	Façade Effect		3	3	3	3	3	3	3	3	
	Estimated Lp at Listener CU01 Only		45	44	36	35	30	26	20	18	37
	Cumulative Noise Level - Plant Noise only		45	44	41	37	34	30	26	31	40

Target Level 46dBA

Acoustic Calibration Services Limited Unit 6H Diamond Industrial Centre Works Road Letchworth Garden City Hertfordshire SG6 1LW Tel: 01462-610085 Mobile: 0771 886 4944 Email: trevjohnlewis@aol.com or



cal@acousticcalibration.co.uk Web: www.acousticcalibration.co.uk

## **CERTIFICATE OF CALIBRATION**

Model: LD LxT1LC1 Serial Number: 025445

**Organisation:** Conabeare Acoustics Limited, 11 Chilton Enterprise Centre, Station Road, Theale, Berkshire RG7 4AA

**Job Number:** 2806

## Customer Order Reference: 10588

The Sound Level Meter was assessed for conformance with International Standard BS EN 61672-3:2006 as modified by TPS 49 Edition 1. The manufacturer claims Class 1 accuracy conformance and it was against these requirements that all the results were evaluated.

The sound level meter was fitted with a PCB 377B02 Serial No. 304334 measurement microphone, a LD PRMLxT1L preamplifier Serial No. 055664 and an unmarked 12 ft microphone extension cable. The microphone was replaced with a suitable input device in order to apply electrical signals to the preamplifier.

A B&K 4231 Acoustic Calibrator Serial No: 2705996 was utilised in establishing the initial acoustic calibration setting.

The sound level meter passed all tests carried out with no deviations from Class 1 specification, in accordance with the modified BS EN 61672-3:2006.

The sound level meter should be set to read **113.8dB** when used with the associated acoustic calibrator, microphone, preamplifier and 12 ft microphone extension cable, 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.

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Certificate No: 15766 Date of Issue: 5<sup>th</sup> March 2020 Signature: Print Name:

Trevor Lewis

Registered Office: Robert Lewis Accountants, 4 Capricorn Centre, Cranes Farm Road, Basildon, Essex SS14 3JJ Registered No: 4143457 VAT No: GB 770505441 Directors: Trevor J Lewis, Owen R Clingan MIOA

## Calibration Certificate

Customer: PC Environmental Ltd. Unit 5,Claylands Park Claylands Road Bishops Waltham Southampton,SO32 1QD,United Kingdom

Model Number	lel Number CAL200 Procedure Number		Procedure Number	D0001.8386				
Serial Number 17720			Technician	mery				
Test Results	sults Pass		Calibration Date	19 Feb 2020				
	As Mar	wfootured	Calibration Due					
Initial Condition	As Manuactured		Temperature	23	°C	± 0.3 °C		
Description	Larson	Davis CAL200 Acoustic Calibrator	Humidity	32	%RH	± 3 %RH		
			Static Pressure	100.9	kPa	±1kPa		
Evaluation Metho	od	The data is aquired by the insert voltage circuit sensitivity. Data reported in dB r	ge calibration method using th e 20 μPa.	ne refere	nce mic	crophone's open		
Compliance Stan	dards	Compliant to Manufacturer Specification	ons per D0001.8190 and the	following	u standa	ards		

ANSI S1.40-2006

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

IEC 60942:2017

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Standards Used							
Description	Cal Date	Cal Due	Cal Standard				
Agilent 34401A DMM	08/15/2019	08/15/2020	001021				
Larson Davis Model 2900 Real Time Analyzer	04/02/2019	04/02/2020	001051				
Microphone Calibration System	03/04/2019	03/04/2020	005446				
1/2" Preamplifier	09/17/2019	09/17/2020	006506				
Larson Davis 1/2" Preamplifier 7-pin LEMO	08/06/2019	08/06/2020	006507				
1/2 inch Microphone - RI - 200V	05/21/2019	05/21/2020	006510				
Pressure Transducer	06/24/2019	06/24/2020	007310				

LARSON DAVIS - A PCB PIEZOTRONICS DIV. 1681 West 820 North Provo,UT 84601,United States 716-684-0001



