ARUP

8 Fitzroy Street

Decarbonisation Project

Acoustic Report

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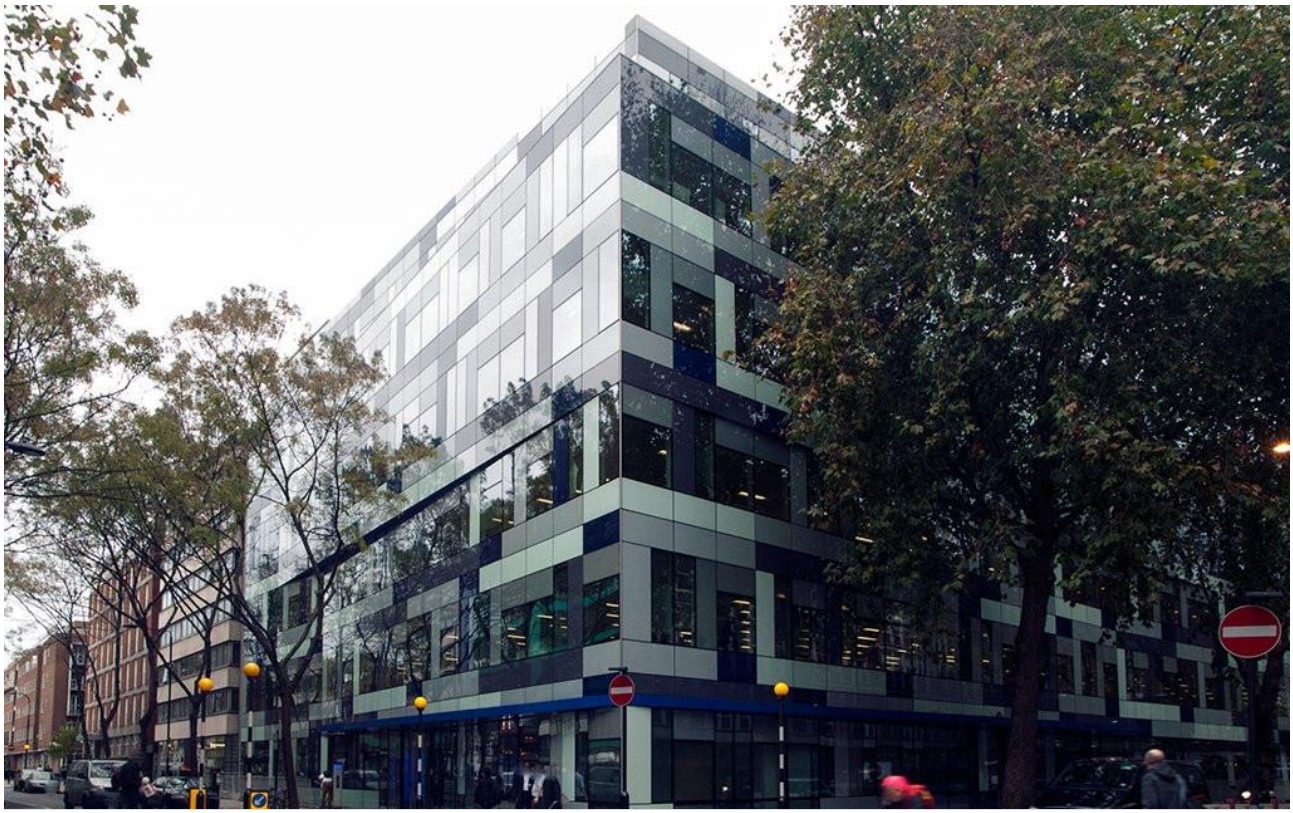

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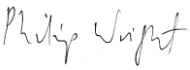
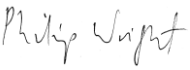
		Signature			
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1. Introduction

8 Fitzroy comprises five levels of offices accommodation. The offices are cooled by Air Cooled Chillers. The building has one set of gas boilers for heating and one set for domestic hot water.

At the time of Fitzrovia Phase 2 & 3 (2005), Arup Acoustics undertook calculations to confirm that this equipment would meet the London Borough of Camden's requirement *"that noise levels predicted at a point 1 metre external to sensitive facades are at least 5 dB(A) less than the existing background measurement (L_{A90}) when the equipment is in operation"*.

At present, the Air-Cooled Chillers have reached the end of their serviceable life and will be replaced with Air Source Heat Pumps (Daikin EWYD6004ZXSB2 +OP76b) that have similar technology but higher energy efficiency. It is noted that the Daikin Air Source Heat Pumps with acoustic enclosure (Lp: 67 dB(A) at 1m) will be less noisy than the existing acoustically enclosed Air-Cooled Chillers (Lp: 70 dB(A) at 1 m). In addition, the gas boilers will be stripped out and heating will be provided by the Daikin Air Source Heat Pumps. The domestic hot water will be provided by 4 new Domestic Air Source Heat Pumps (Mitsubishi QAHV – N560YA-HPB). The various plant will only be in operation during working hours, between 7:00 AM and 19:00 PM.

Currently, London Borough of Camden requires a rating level of 10 dB(A) below the background noise L_{A90} measured outside living or dining or bedroom window (façade) of a dwelling to be considered for new plant. Thus, Arup has carried out an analysis of the noise emissions from the proposed plant in relation to the current planning requirements, with the aim of a corresponding 5dB reduction in emissions as compared with the 2005 installations. This report presents the outcome of that analysis.

2. Policy and guidance

2.1 Local Planning Policy

In the Appendix 3: Noise Threshold of Camden Local Plan dated 2017 under the section Industrial and Commercial Noise Sources it is stated that:

"A relevant standard or guidance document should be referenced when determining values for LOAEL (Lowest Observed Adverse Effect Level) and SOAEL (Significant Observed Adverse Effect Level) 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 SOAL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and Outside living or dinning 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 of exceeding 57dB L_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L_{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88 dB L_{Amax}

Table 1 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 1 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.*

3. Site description

The existing building on site is an office building operating between 7:00 AM and 19:00 PM, situated in a commercial area of the London Borough of Camden, noisy in nature during daytime hours (7:00 – 19:00). It is bounded by Maple Street to the Northwest, Whitfield Street to the Northeast, Fitzroy Street to the Southwest and Howland Street to the Southeast.

Figure 1 shows the site context, including the locations of the nearest noise sensitive receptors (NSRs). Table 2 summarises the type of the NSRs.

Figure 1 Site context and locations of the noise sensitive receptors (NSR).

Noise Sensitive Receptor (NSR)	Name	Type
1	Montagu House	Residential
2	King Regent's Place	Residential
3	The Carpenters Arms	Public House

Table 2 Type of the noise sensitive receptors (NSR).

4. Noise emission limits

Table 3 outlines the cumulative noise emission limits that apply to the existing noise levels which satisfy the planning requirement.

Previous project experience has indicated that the proposed Air Source Heat Pump units will not contain attention catching characteristics such as audible tonal elements which would require a penalty to be applied to the L_{eq} level in order to obtain the rating level.

The newly proposed equipment will comply with this limit.

Noise Sensitive Receptor	Existing background noise limit (2005)	Proposed background noise limit (2024)
	External building services noise emission limits (dBLAr,Tr)	External building services noise emission limits (dBLAr,Tr)
	Daytime (7:00 to 19:00)	Daytime (7:00 to 19:00)
Montagu House	38	**33**
King Regent's Place	46	**41**
The Carpenters Arms	56	**51**

Table 3 Noise emission limits.

5. Analysis

The proposed locations of the Air Source Heat Pumps that will replace the Air-Cooled Chillers, as well as those of the 4 new Domestic Hot Water Air Source Heat Pumps, are shown in Figure 2**Error! Reference source not found.**.

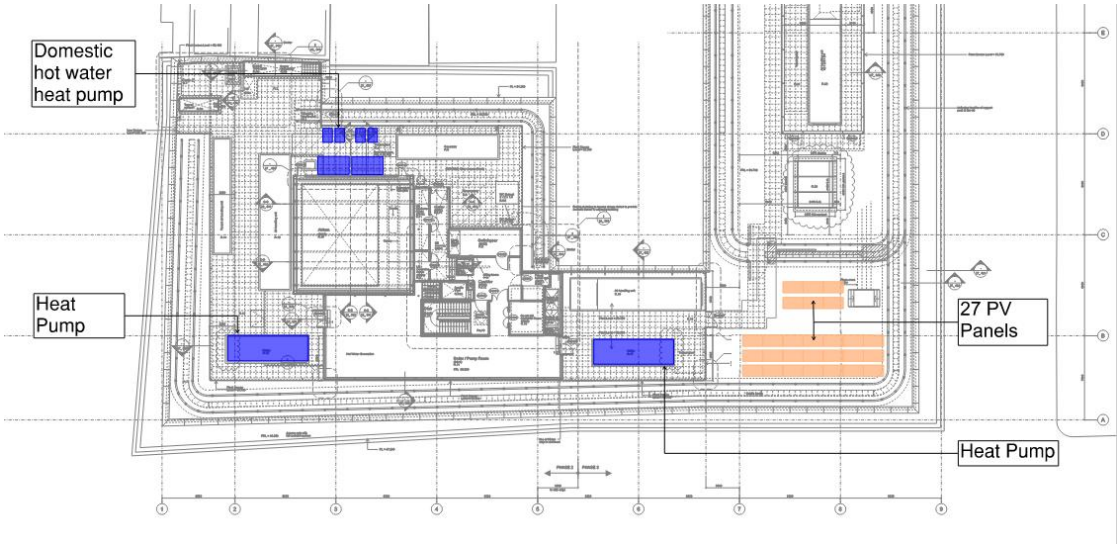

Figure 2 Proposed locations of the Air Source Heat Pumps and of the Domestic Hot Water Heat pumps on the roof level of 8 Fitzroy Street.

Table 4 shows the noise levels of the proposed plant as provided by the manufactures. Cumulative sound pressure levels were calculated at the noise sensitive receptors based on the propagation distances and screening conditions provided by the existing screens on the roof level of 8 Fitzroy. The calculations included the insertion loss provided by an acoustic enclosure type AA203S (Figure 3) that is being proposed for the Daikin Air Source Heat Pump units. Table 5 summarises the results of the calculations.

Type	Manufacturer	Model	Sound pressure at 1.0 m distance from the unit dB(A)
Air Source Heat Pump (ASHP)	Daikin	EWYD6004ZXSB2 +OP76b	75 (67 with acoustic enclosure)
Domestic Hot Water Air Source Heat Pump	Mitsubishi	QAHV – N560YA – HPB	56

Table 4 Proposed plant noise levels.

Noise Sensitive Receptor	Daytime (07:00 – 19:00)	
	Predicted noise level ($dBL_{Ar,Tr}$)	Noise emission limit ($dBL_{Ar,Tr}$)
Montagu House	33	33
King Regent's Place	37	41
The Carpenters Arms	30	51

Table 5 Predicted noise levels at the nearby noise sensitive receptors.

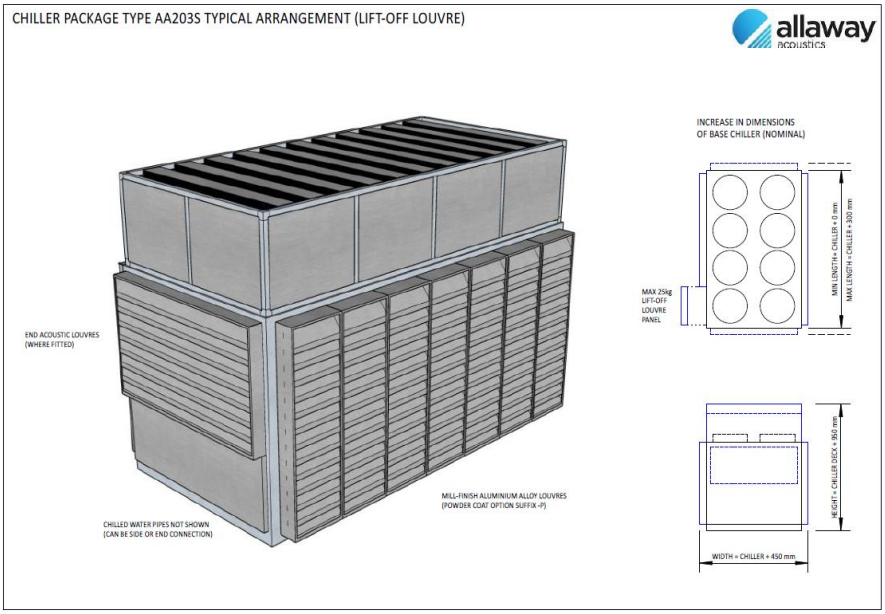

Figure 3 Proposed acoustic enclosure for the Air Source Heat Pump units.

6. Conclusion

Plant noise emissions were calculated for the proposed Air Source Heat Pump units, and it has been shown that the plant noise emissions will satisfy the noise emission limits that apply according to London Borough of Camden planning requirements.

Appendix A – Acoustic Terminology

Decibel (dB)

The ratio of sound pressures which we can hear is a ratio of 10^6:1 (one million: one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound pressure level' (L_p) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

dBA

The unit used to define a weighted sound pressure level, which correlates well with the subjective response to sound. The 'A' weighting follows the frequency response of the human ear, which is less sensitive to low and very high frequencies than it is to those in the range 500Hz to 4kHz.

In some statistical descriptors the 'A' weighting forms part of a subscript, such as L_{A10}, L_{A90}, and L_{Aeq} for the 'A' weighted equivalent continuous noise level.

Equivalent continuous sound level

An index for assessment for overall noise exposure is the equivalent continuous sound level, L_{eq}. This is a notional steady level which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

Frequency

Frequency is the rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the hertz (Hz), which is identical to cycles per second. A 1000Hz is often denoted as 1kHz, eg 2kHz = 2000Hz. Human hearing ranges approximately from 20Hz to 20kHz. For design purposes the octave bands between 63Hz to 8kHz are generally used. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For more detailed analysis, each octave band may be split into three one-third octave bands or in some cases, narrow frequency bands.

Sound power level

The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source. The sound power level is an intrinsic characteristic of a source (analogous to its volume or mass), which is not affected by the environment within which the source is located.

Sound pressure level

The sound power emitted by a source, results in pressure fluctuations in the air, which are heard as sound. The sound pressure level (L_p) is ten times the logarithm of the ratio of the measured sound pressure (detected by a microphone) to the reference level of 2×10^{-5}Pa (the threshold of hearing).

Thus, L_p (dB) = 10 log $(P1/P_{ref})^2$ where P_{ref}, the lowest pressure detectable by the ear, is 0.00002 pascals (ie $2x10^{-5}$ Pa).

The threshold of hearing is 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dBL_A and a change of 3dB is only just detectable. A change of 10dB is subjectively twice, or half, as loud.

Statistical noise levels

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index which allows for this variation. The L_{10}, the level exceeded for 10% of the time period under consideration, and can be used for the assessment of road traffic noise (note that L_{Aeq} is used in BS 8233 for assessing traffic

noise). The L_{90}, the level exceeded for 90% of the time, has been adopted to represent the background noise level. The L_1, the level exceeded for 1% of the time, is representative of the maximum levels recorded during the sample period. A weighted statistical noise levels are denoted L_{A10}, dBL_{A90} etc. The reference time period (T) is normally included, e.g. $dBL_{A10, 5min}$ or $dBL_{A90, 8hr}$.

Typical levels

Some typical dB(A) noise levels are given below:

Noise Level, dB(A)	Example
130	Threshold of pain
120	Jet aircraft take-off at 100m
110	Chain saw at 1m
100	Inside disco
90	Heavy lorries at 5m
80	Kerbside of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heater at 1m
40	Living room
30	Theatre
20	Remote countryside on still night
10	Sound insulated test chamber