Price & Myers

35-37 Alfred Place

Noise Assessment Report

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13 Fitzroy Street
London
W1T 4BQ
United Kingdom

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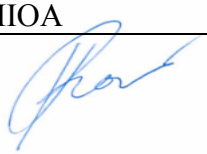
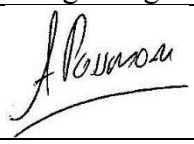
		Signature			
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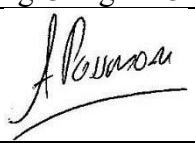
		Signature			
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Appendices

1 Introduction

Arup has been appointed to provide an acoustic assessment to assist with the planning application for a new air handling unit, kitchen fan and toilet extract fan which are proposed to be installed on a first floor roof and in an adjacent plant well at the rear of 35-37 Alfred Place.

The new AHU is primarily to ventilate the basement canteen which will mostly be used during lunchtime hours.

A noise survey has been conducted to establish the background noise levels outside the nearest residential dwelling during the hours of plant operation. This has been used to establish plant noise limits in line with the requirements of Camden Council to protect the occupants of nearby dwellings.

This report summarises the approach and results of the survey, presents the noise emission limits and provides an assessment of the noise emission from the proposed new plant.

A glossary of acoustic terminology is presented in Appendix A.

2 The site and surroundings

The proposed new AHU is to be located on a first floor rooftop as shown in Figures 1 and 2.

35-37 Alfred Place is bounded to the east by a loading bay, to the west by Alfred Place, to the south by residential properties on Store Street and by 33-34 Alfred Place building to the north. The proposed location of the new plant is set out in Figures 1.

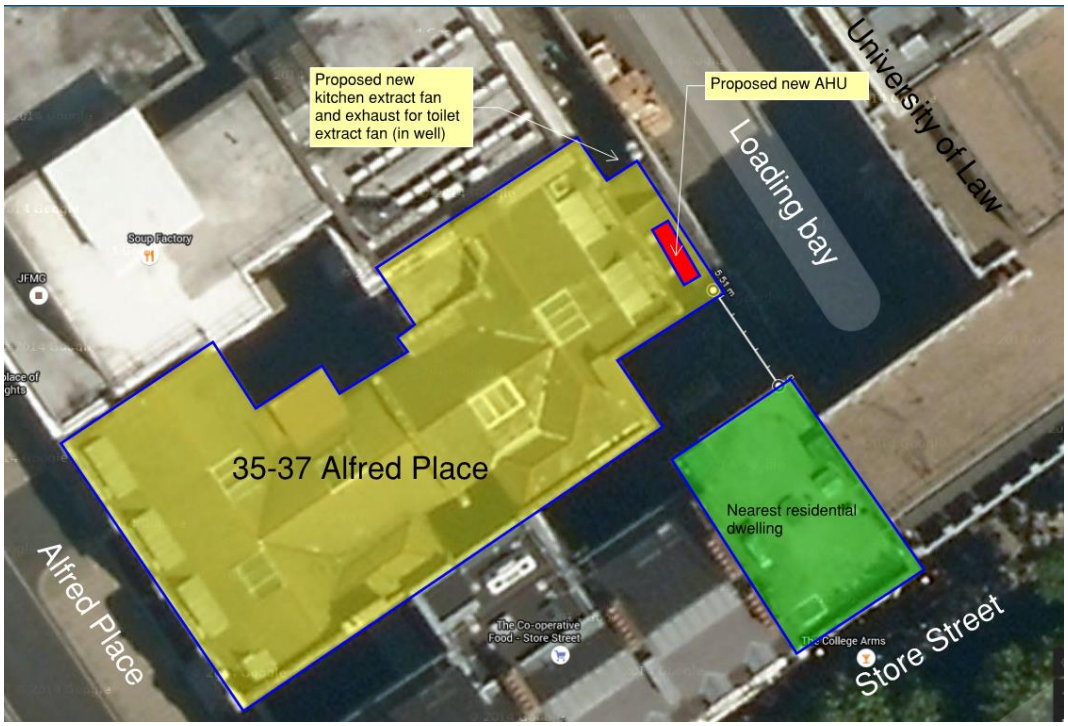

Figure 1: Proposed location of new plant

3 Noise sensitive receptors

The nearest noise sensitive receptor to the proposed new plant is a flat to the south, which has an openable window approximately 6m from the area of flat roof where the new AHU is proposed.

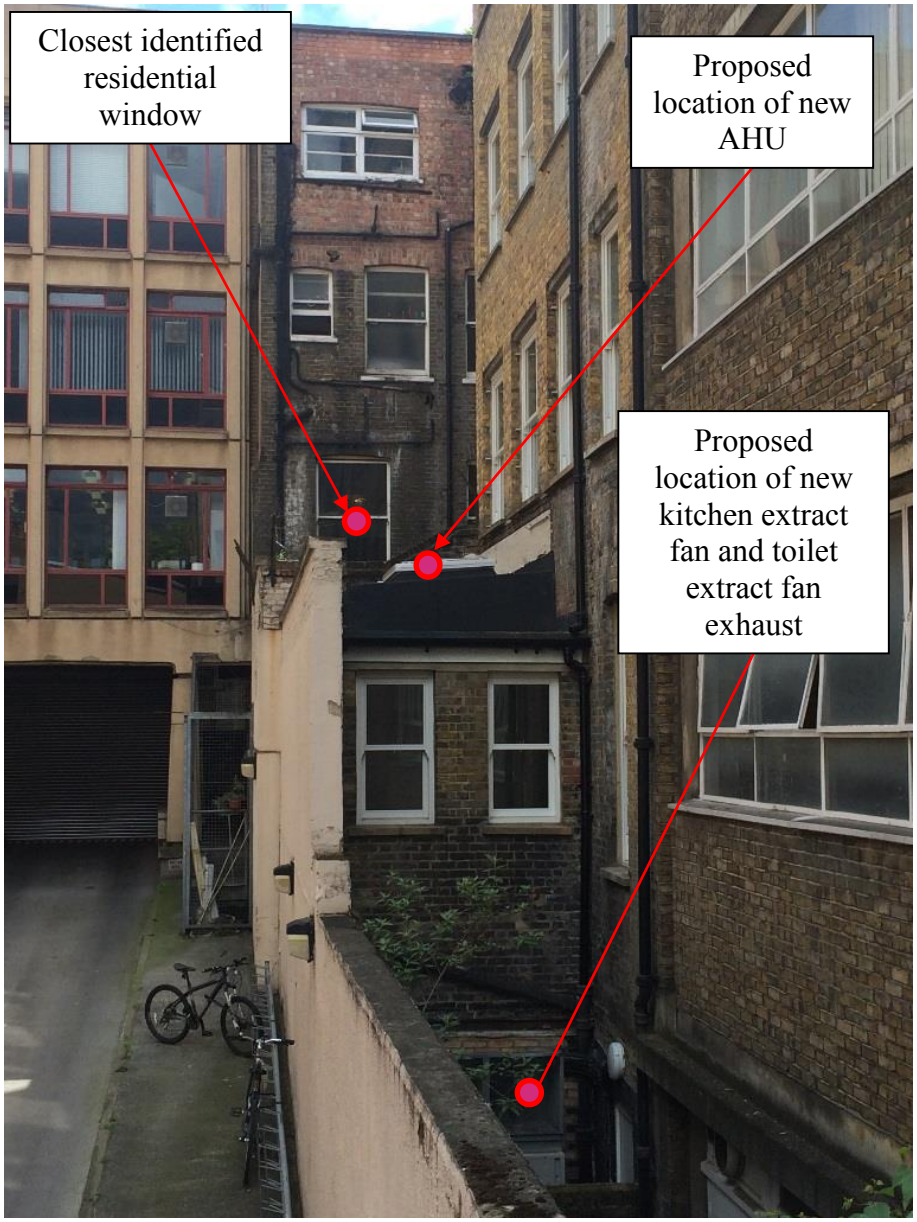

Figure 2: Location of proposed new plant in relation to nearest residential property

4 Baseline noise survey

4.1 Aims

The purpose of the environmental noise survey was to measure the quietest noise levels during the proposed operating hours of the new plant at a location representative of outside the nearest residential window, to determine noise emission criteria in accordance with the requirements of Camden Council.

A noise logger was installed on the rooftop which is proposed to support the new AHU.

4.2 Measurement details

The noise monitor was installed and measurements performed by Romans Popovs of Arup, who is an Associate Member of the Institute of Acoustics.

The noise survey was conducted between 14:26 on Friday 22 May 2015 and 10:56 on Friday 29 May 2015.

Weather conditions during the measurements were dry apart from some light rain on the morning of 29 May.

4.3 Measurement locations

The measurement location is presented in Figure 3.

Figure 3: Logger and attended measurement location

During the attended measurements, noise was dominated by small condenser units which are located directly outside the nearest residential window as shown below.

Figure 4: Condenser units close to the noise logger position and directly adjacent to the nearest residential window

The logger was approximately 8m away from these units and the window, so the measured noise levels can be considered to be below the noise levels directly outside the window, providing a margin of safety in the calculations.

Figure 5: Other condenser units in the loading bay, viewed from the logger position

Figure 6: Other condenser units in the loading bay, viewed from the logger position

Figure 7: Other condenser units in the loading bay, viewed from the logger position

4.4 Equipment and methodology

During the noise survey, L_{Aeq}, L_{A10}, L_{A90} and L_{Amax} indices were recorded.

All measurements during the survey were made over 5 minute periods. This covers a 'worst case' in comparison with BS1412:2014 which refers to a 1 hour reference time interval during the day.

Measurements were carried out using the equipment detailed in Table 1. The sound level meter and microphone are Type 1 conforming to BS EN 61672-1: 2003. The sound level meter and microphone were calibrated before and after use, to confirm that there was no significant drift in meter response at the calibrator frequency and level. This verification indicated that there was no more than a 0.1 dB variation between checks. The meter is annually calibrated and this calibration is traceable to international standards. All measurements were made with A-weighting and fast (0.125s) time constant.

Manufacturer	Serial	Type Number	Instrumentation
Rion	34773051	NC-74	Sound Pressure Level Calibrator
Rion	00451285	NL-32	Sound Level Meter
Rion	308532	UC-53A	½" Microphone
Rion	15278	NH-21	Preamplifier

Table 1: Noise survey measurement equipment

The microphone was located approximately 1m from the building facade. All of the measured noise levels are therefore facade measurements. All measurements discussed in the main body of the report have been corrected to free-field by subtracting 3dB apart from the data presented on Figure 8, which represents the raw data ie not corrected to free-field.

4.5 Results

Figure 8 presents the measured noise levels from at the logger position.

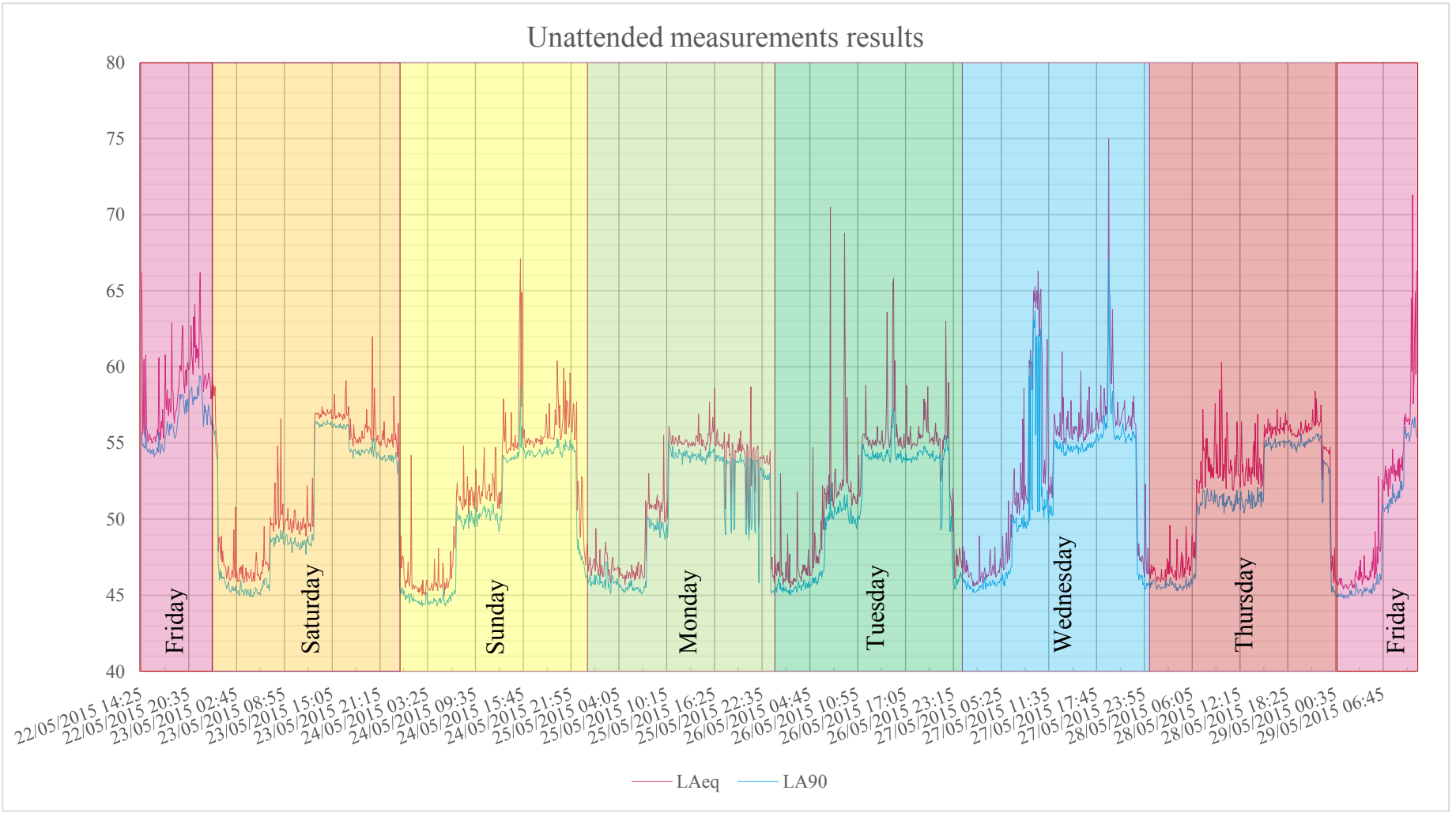

Figure 8: Measured noise levels at the logger position

5 Design criteria

Table E of Camden Development Policy *DP28 - Noise and Vibration (2010)* sets out requirements for noise emission from new plant relative to the existing background noise.

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	5dB(A) <LA90
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
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) <LA90
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	55dB$_{LAeq}$

Table 2: Camden Council noise emission requirements from DP28

Despite the title of the table, we understand that if the requirements of Table E are complied with, planning permission will be granted.

Table E does not define a measurement period, so the assessment has been based on the lowest measured $L_{A90(5\ mins)}$ during the proposed operating hours of the plant.

The new AHU and kitchen fan will generally only operate during the middle of the day. However, for the purposes of this assessment, it is assumed that it could run at any time during office hours 0800 – 1900 on weekdays.

The lowest measured noise level during these hours was 49dB$L_{A90(5\ mins)}$ at 10am on Monday 25 May 2015. Taking into account a 3dB façade correction, the minimum background noise incident on the nearest residential window is assumed to be 46dB$L_{A90(5\ mins)}$. On this basis, and the requirements of Camden Council, the plant noise emission requirements are set out below.

Noise description and location of measurement	**Maximum total noise level from new plant dB(A)**
Noise level at 1m external to nearest sensitive façade	41
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1m external to a sensitive façade.	36
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade.	36

Table 3: Specific noise emission requirements

6 Plant noise assessment

6.1 Air handing unit

The manufacturer has provided the following noise data for the proposed AHU:

	Sound Power Level re 1pW dB Octave Band Centre Frequency, Hz							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
In duct fresh air intake (including attenuator)	57	51	56	41	30	28	33	33
In duct exhaust (including attenuator)	59	54	57	41	36	29	31	30
Casing radiated	61	60	66	52	56	50	47	43

Table 4: Specific noise emission requirements

Using this data, the noise incident on the nearest residential window has been calculated, taking into account the following:

- loss with distance
- local reflecting surfaces

The results of the calculations are set out below:

AHU noise source	**Noise level incident on nearest window dB(A)**
Casing radiated	38
Fresh air intake	28
Exhaust	29
Total	39

Table 5: Calculated noise levels

6.2 Kitchen extract fan

The kitchen extract fan is proposed to be located in the plant well in the location shown in Figure 2. The exhaust will be ducted to a cowl at roof level.

The manufacturer has provide the following noise data:

	Sound Power Level dB re 1pW Octave Band Centre Frequency, Hz						
	125	**250**	**500**	**1k**	**2k**	**4k**	**8k**
In-duct sound power level	72	78	75	75	72	69	62

Table 6: Kitchen extract fan noise levels

Breakout sound pressure level at 3m, spherical, free field	57dB(A)

For the exhaust, taking into account attenuator insertion loss and regenerated noise, duct loss, end reflection, distance and directivity, the noise level incident on the nearest residential window has been calculated as 33dB(A).

For the fan breakout, due to a significant barrier effect from the wall of the plant well, the breakout fan noise has been calculated as 30dB(A).

6.3 Toilet extract fan

The toilet extract fan will be located inside the building with the exhaust ducted into the plant well shown in Figure 2.

The manufacturer has provide the following noise data:

	Sound Power Level dB re 1pW Octave Band Centre Frequency, Hz						
	125	**250**	**500**	**1k**	**2k**	**4k**	**8k**
In-duct sound power level	54	59	66	67	61	56	45

Table 7: Toilet extract fan noise levels

Taking into account loss with distance, local reflections and the significant barrier effect from the plant well wall, the noise level from the toilet extract fan exhaust has been calculated as 22dB(A).

6.4 Total noise

Assuming all of the new items of plant can run simultaneously, the table below sets out the calculated total noise level from these sources.

As long as the proposed plant noise is not tonal or impulsive in character, it complies by calculation with the requirements of Camden Council.

Noise source	**Noise level incident on nearest residential window dB(A)**
AHU casing radiated	38
AHU fresh air intake	28
AHU exhaust	29
Kitchen extract fan casing radiated	30
Kitchen extract exhaust	33
Toilet extract fan exhaust	22
Total	**40**

Table 8: Total noise level from all plant

7 Conclusions

A noise survey has been conducted to determine the minimum background noise levels outside the nearest residential property to the proposed new plant. These have been used to establish noise emission limits in accordance with the requirements of Camden Council.

Based on manufacturer's data for the proposed plant, the noise emission requirements of Camden Council will be met as long as the plant noise is not tonal or impulsive in character.

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.

dB(A)

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 x 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. dB$L_{A10, 5min}$ or dB$L_{A90, 8hr}$.

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