clarke saunders | acoustics
specialist consultants

REPORT AS10099.180425.NIA.2.0

LEVEL 4 BAR/LEVEL 5 OFFICE
UCL IOE
20 BEDFORD WAY
LONDON

NOISE IMPACT ASSESSMENT

Prepared: 26 April 2018

Mace
155 Moorgate
London
EC2M 6XB

Head Office -
Westgate House
39 - 41 Romsey Road
Winchester
SO22 5BE
mail@clarkesaunders.com

London Office -
103 Gaunt Street
London
SE1 6DP
london@clarkesaunders.com

Exeter Office -
Sowton Business Park
Capital Court
Bittern Road
Sowton, Exeter
EX2 7FW
exeter@clarkesaunders.com

Tel: +44 (0) 1962 872130
mail@clarkesaunders.com

www.clarkesaunders.com

CONTENTS

List of Attachments

1.0 INTRODUCTION

This report has been prepared for a planning and listed building consent application in the wing at the Institute of Education of the University College London (UCL), 20 Bedford Way, London. The proposal is to move the current bar from 3rd floor level to 4th floor level and office accommodation at 5th floor level. The proposed bar is likely to be open from 11:00 – 00:00 on Monday to Friday, and is only to open on Saturday once per month.

Clarke Saunders Associates (CSA) has been commissioned by MACE to ascertain the noise impact of proposed plant associated with these uses at the nearest residential receptor. CSA has undertaken an environmental noise survey to measure the prevailing background noise climate at the proposed site. The background noise levels measured will be used to determine daytime and night-time noise emission limits for new building services plant in accordance with the planning requirements of Camden Council.

The proposed level 4 bar/level 5 office will require a single air handling unit (AHU) and mechanical ventilation heat recovery (MVHR) unit. The proposed AHU is to be stored in a plant room at 4th floor level. The MVHR will also be placed at 4th floor level, but positioned towards the south-west façade of the wing.

No formal assessment of noise breakout from the bar affecting noise sensitive receptors is included at this stage since the location and use of the spaces is commensurate with the existing uses and as such no significant change in impact would be expected.

2.0 SITE DESCRIPTION

The proposed site is the wing protruding towards the south west from the Institute of Education, 20 Bedford Way.

The wing at 20 Bedford Way is currently a mixed-use building containing offices and lecture halls. The proposal is for the Level 3 bar to move to Level 4, and the Level 4 office to move to Level 5.

Surrounding buildings are largely educational and commercial uses. CSA has contacted Environmental Health at Camden Council to confirm that the noise of the new plant is to be assessed to the Royal National Hotel on Bedford Way which is considered the nearest critical sensitive receptor.

The nearest window at the Royal National Hotel is at least 64 metres from the fresh air inlet and exhaust of the AHU unit, and at least 93 metres from the fresh air inlet and exhaust of the MVHR unit. The main building of 20 Bedford Way blocks the line of sight from the proposed bar site to the hotel.

3.0 NOISE SURVEY PROCEDURE & EQUIPMENT

A survey of the existing background noise levels was undertaken at two locations to obtain a representative of the current background noise climate at the proposed site and at the nearest residential receptor. The locations of the two noise monitors, LT1 and LT2, are shown in site plan AS10099/SP2, as well as the positions of the proposed plant.

These monitoring positions were selected for the survey as part of previous application for the temporary bar plant, however, they are considered appropriate for this application.

The existing noise levels at these positions have been used together with the noise levels for the proposed plant to assess the cumulative predicted noise impact.

For the environmental noise survey, measurements of consecutive 5-minute L_{Aeq}, L_{Amax}, L_{A10}, and L_{A90} sound pressure levels were taken between 13:05 hours on Tuesday 5th December and 09:50 hours on Thursday 7th December 2017.

The following equipment was used during the course of the survey:

- NTi data logging sound level meter type XL2;
- Rion data logging sound level meter type NL52;
- Rion sound level calibrator type NC-74.

The calibration of the sound level meters was verified before and after use. No significant calibration drift was detected.

The weather during the survey was generally dry with light winds, which made the conditions suitable for the measurement of environmental noise.

Measurements were following procedures in BS 7445:1991 (ISO1996-2:1987) *Description and measurement of environmental noise Part 2- Acquisition of data pertinent to land use* and BS4142:2014 *Methods for rating and assessing industrial and commercial sound*.

Please refer to Appendix A for details of the acoustic terminology used throughout this report.

4.0 RESULTS & ANALYSIS

Figures AS10099/TH1-TH4 show the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels as time histories at the two measurement positions, as marked by site plan AS10099/SP2.

The background noise climate at LT1 is determined by distant road traffic noise with a contribution from pedestrians in the vicinity. The background noise climate at LT2, representative of the residential receptor, is determined by road traffic noise from Bedford Way and Russell Square with a contribution from building services noise.

Measured average noise levels and typical background noise levels are shown in Table 4.1 below.

Monitoring Period	*Typical $L_{A90, 5mins}$		$L_{Aeq, 5mins}$	
	LT1 (UCL)	LT2 (Bedford Way)	LT1 (UCL)	LT2 (Bedford Way)
07:00 – 23:00 hours	49	54	55	60
23:00 – 07:00 hours	45	49	50	56

Table 4.1 – Typical background and average noise levels at the two monitoring positions **[dB ref. 20µPa]**

**typical background calculated as 10% percentile of $L_{A90,5min}$ data measured during this period*

The noise survey data recorded shows that there is a reduction in the overall average noise levels of approximately 5dB between daytime and night-time periods. Average noise levels at the proposed bar area (LT1) are in the low to mid 50's, whilst they are in the mid to high 50's at roof level near the Royal National Hotel (LT2). This is consistent with a Central London location.

5.0 DESIGN CRITERIA

5.1 Local Authority Requirements

Camden Council adopted the new Local Plan on 3 July 2017 which describes 'noise thresholds' in Appendix 3.

Discussion with Edward Davis, Environmental Health Officer at Camden Council on Thursday 14th December 2017 has confirmed that:

Survey measurement procedures for fixed plant noise assessments and determination of the typical background noise level should follow the methodology set out in BS4142:2014 *Methods for rating and assessing industrial and commercial sound*. The subsequent assessment of fixed plant noise emissions does not need to be in accordance with BS4142:2014 where character penalties could be imposed. Instead the policy requires the plant noise emissions at the nearest residential receptor to be 10dB below the typical background ($L_{A90,15min}$) during the proposed operational period, and if tonal, 15dB below the typical background ($L_{A90,15min}$) during the proposed operational period.

The assessed plant is not expected to have tonal content. On this basis, the plant noise emissions criteria are shown in Table 5.1.

Monitoring Period	Plant Noise Emissions Criteria ($L_{Aeq,T}$)
07:00 – 23:00 hours	44
23:00 – 07:00 hours	39

Table 5.1 – Plant noise emissions criteria at nearest residential receiver (Royal National Hotel) [dB ref. 20µPa]

5.2 BS8233:2014 Guidance on sound insulation and noise reduction for buildings

The guidance in this document indicates suitable noise levels for various activities within residential and commercial buildings.

The relevant sections of this standard are shown in the following table:

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq, 16 hour}$	-
Dining	Dining Room	40 dB $L_{Aeq, 16 hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16 hour}$	30 dB $L_{Aeq, 8 hour}$

Table 5.2 - Excerpt from BS8233: 2014 [dB ref. 20µPa]

6.0 PREDICTED NOISE IMPACT

6.1 Proposed plant impact

The selected plant has been confirmed as:

- 1 no. FlaktWoods Air Handling Unit eQ Prime (AHU)
- 1 no. FlaktWoods Air Handling Unit Eco Premium Essential (MVHR)

The approximate location of the proposed fresh air inlets and exhaust outlets are shown in site plan AS10099/SP2.

Operational atmospheric side sound power levels generated by the AHU and MVHR units have been confirmed by the manufacturer as follows:

Plant Unit	Noise Source	Freq (Hz)	63	125	250	500	1000	2000	4000	8000	dB(A)
AHU	Fresh Air Inlet	L_w (dB)	67	70	55	48	47	46	42	40	57
	Exhaust	L_w (dB)	65	76	67	64	61	61	58	56	68
MVHR	Fresh Air Inlet	L_w (dB)	72	65	59	58	55	43	30	30	59
	Exhaust	L_w (dB)	75	74	75	73	71	68	67	63	76

Table 6.1 – Atmospheric side source noise data for the AHU and MVHR [dB ref. 20µPa]

6.2 Predicted noise levels

Following an inspection of the site, the nearest noise sensitive receiver (the Royal National Hotel), is situated on Bedford Way at 7th floor level, as shown on the indicative site plan AS10099/SP2. This window is at least 55 metres away from the nearest proposed plant louvre.

The cumulative noise level at the nearest noise sensitive receiver has been calculated on the basis of manufacturer's plant data and drawings available at the time of writing.

Screening losses afforded by the south-west façade of 20 Bedford Way have been included in the prediction of the cumulative plant noise level at the nearest receiver.

Receptor	Predicted plant noise emissions at nearest receptors, $L_{Aeq,T}$, dB	Plant Noise Emissions Criteria ($L_{Aeq,T}$)
Royal National Hotel	14	39

Table 6.2 - Predicted cumulative plant noise level at receptor [dB ref. 20 µPa]

A summary of the calculations is shown in Appendix B.

The cumulative plant noise emission level is seen to have no adverse noise impact on the Royal National Hotel at any time period of the day. It complies with the local authority's requirements.

6.3 Comparison to BS8233:2014 Criteria

BS8233 assumes a loss of approximately 15dB for a partially open window. The external noise level shown in Table 6.2 would result in an internal noise levels that would meet the levels shown in Table 5.2. It is likely that the AHU and MVHR unit will also run with lower duty cycles if at all during the night-time periods resulting in a further reduction to the predicted plant noise emissions.

7.0 CONCLUSION

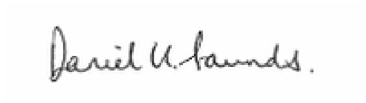
A noise impact assessment for the installation of new building services plant as part of the relocation of bar and office uses has been undertaken by Clarke Saunders Associates at 20 Bedford Way, assessing the noise from the proposed fixed plant at the nearest residential receptor.

An environmental noise survey was undertaken at UCL, 20 Bedford Way between 13:05 hours on Tuesday 5th December and 09:50 hours on Thursday 7th December 2017.

Measurements have been undertaken to establish the current background and ambient noise climate, and used alongside the proposed plant data to verify compliance with the Camden Council's requirements.

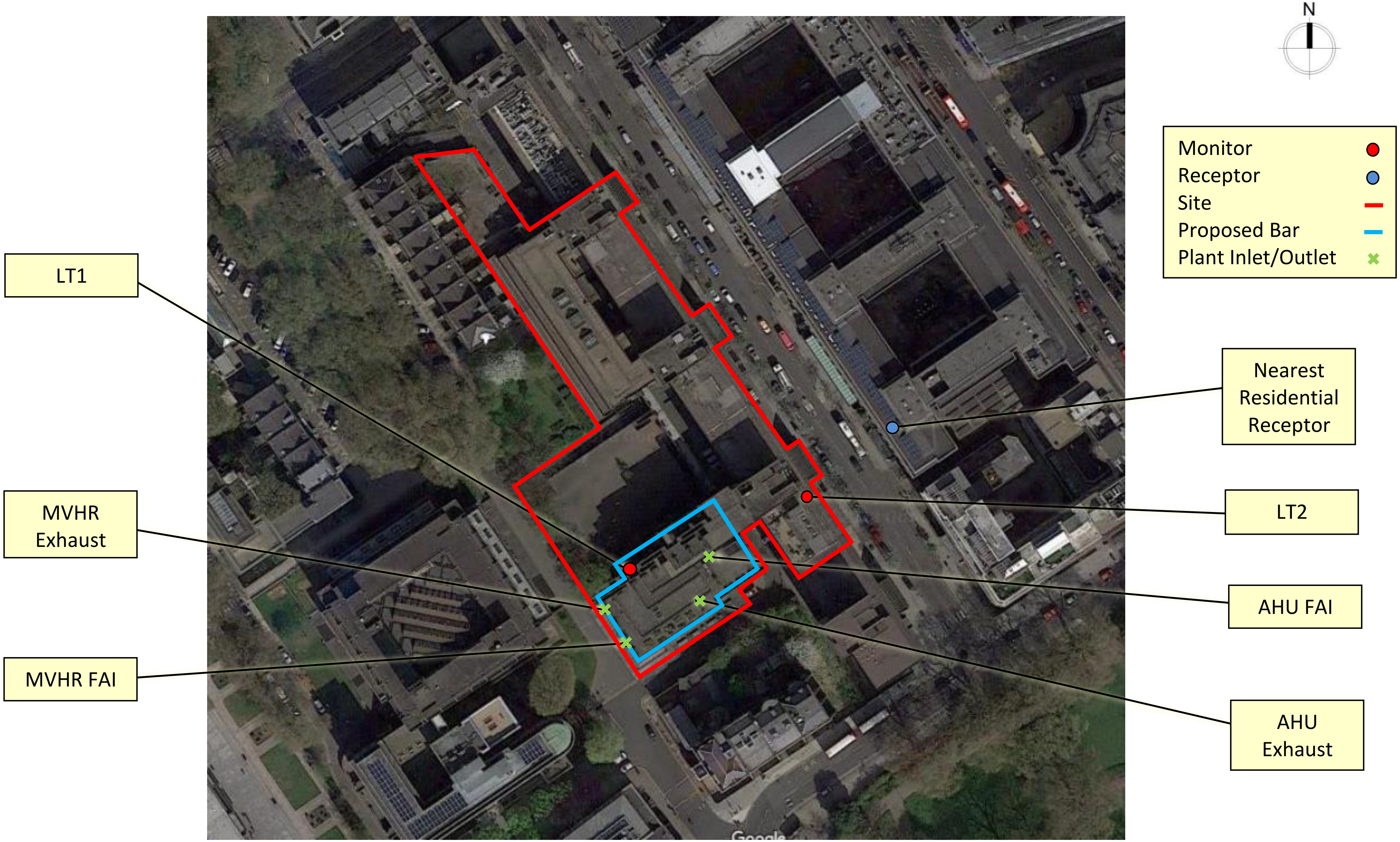
Data for the new AHU and MVHR units have been used to predict the noise impact of the new plant on neighbouring residential properties.

Compliance with plant noise emission criteria at the nearest residential receptor has been demonstrated and no mitigations measures are required.



Daniel Saunders MIOA

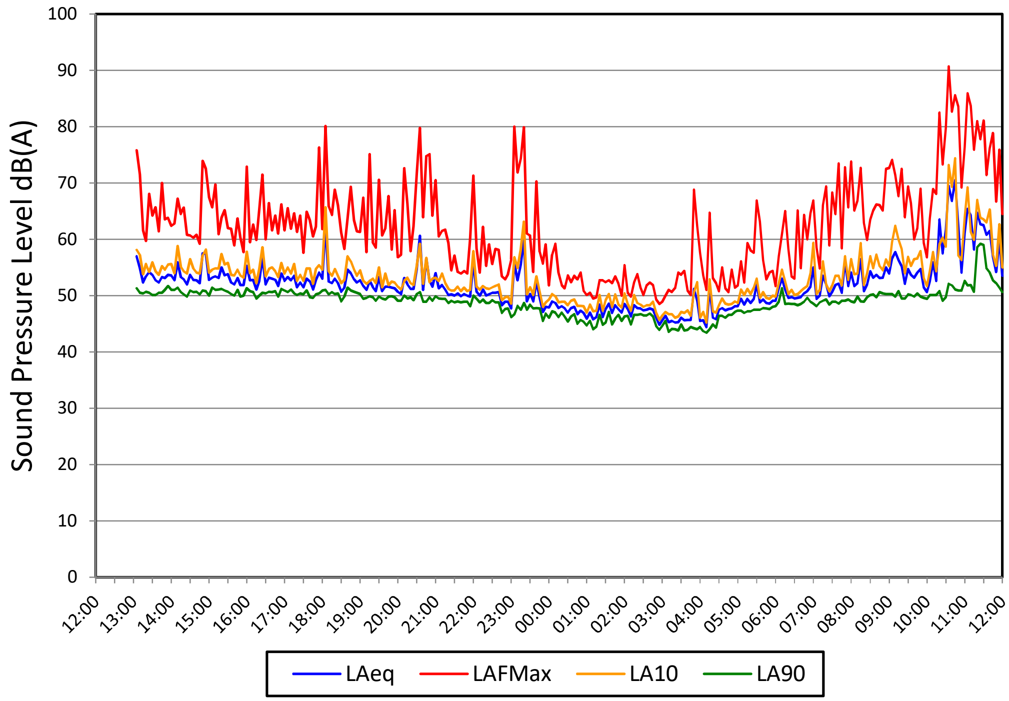
CLARKE SAUNDERS ASSOCIATES



clarke saunders | acoustics

UCL, IoE, 20 Bedford Way, London

Environmental Noise Time History: LT1

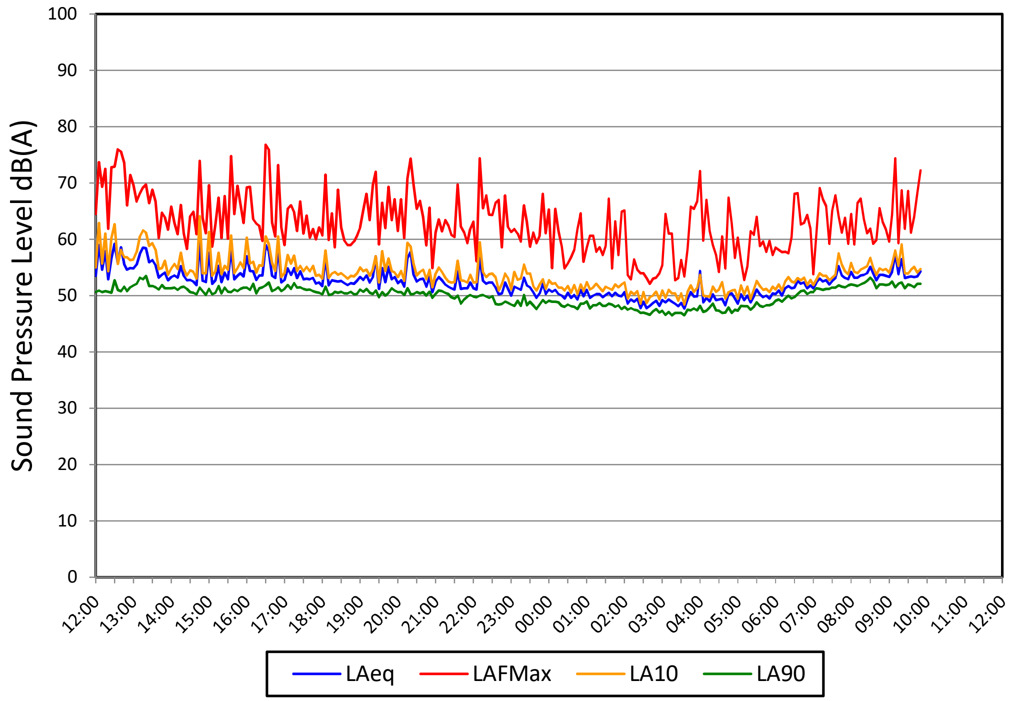


Tuesday 05 December to Wednesday 06 December 2017

Figure AS10099/TH1

UCL, IoE, 20 Bedford Way, London

Environmental Noise Time History: LT1

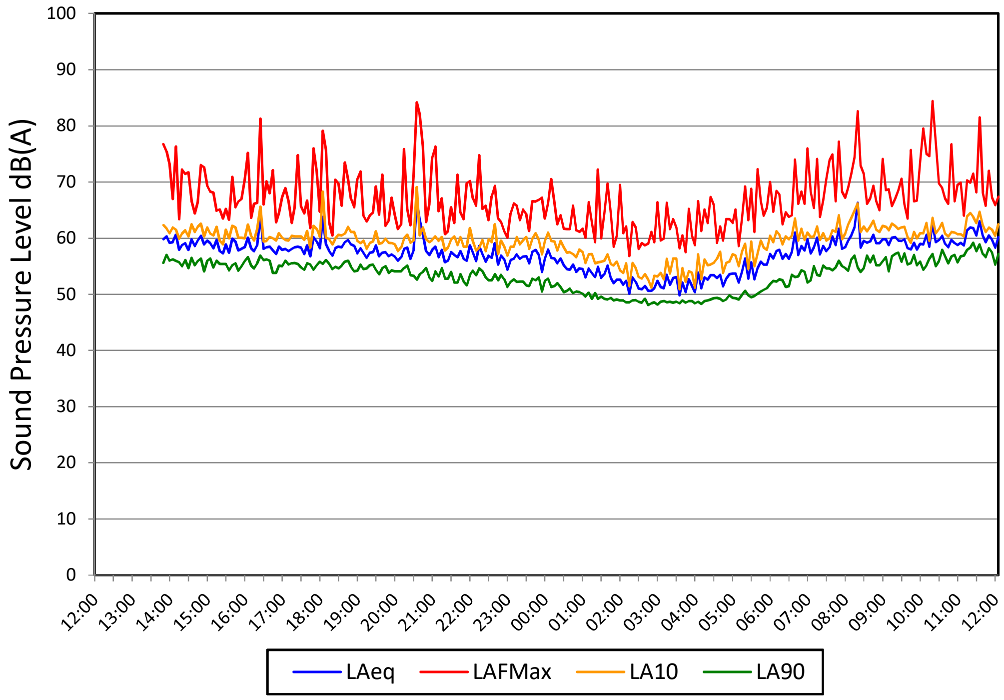


Wednesday 06 December to Thursday 07 December 2017

Figure AS10099/TH2

UCL, IoE, 20 Bedford Way, London

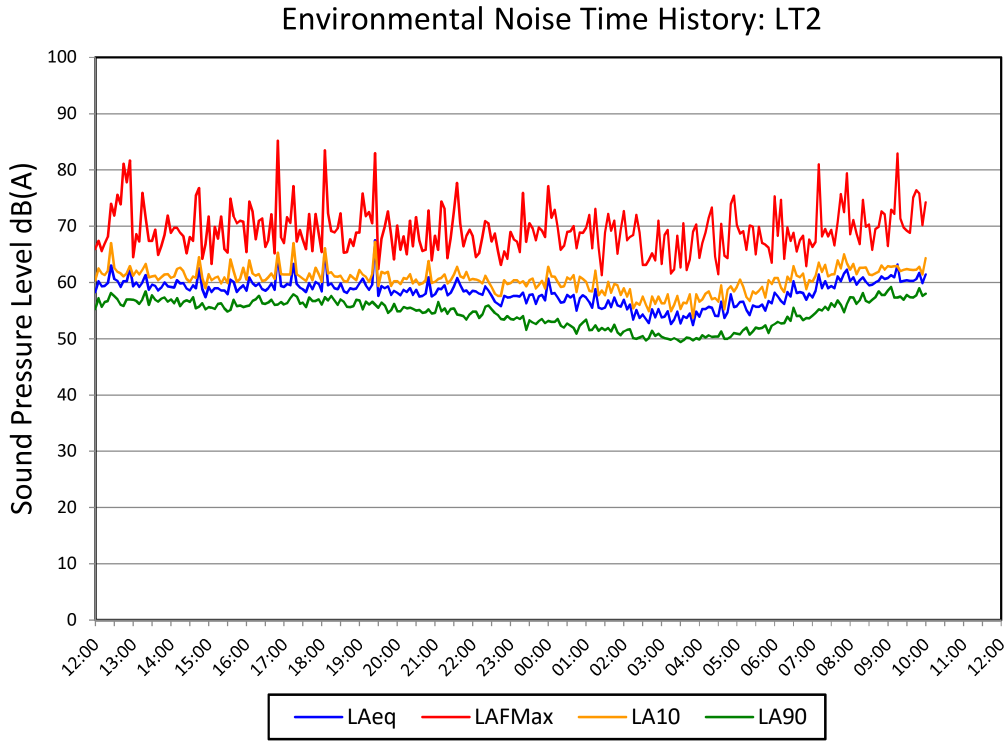
Environmental Noise Time History: LT2



Tuesday 05 December to Wednesday 06 December 2017

Figure AS10099/TH3

UCL, IoE, 20 Bedford Way, London



Wednesday 06 December to Thursday 07 December 2017

Figure AS10099/TH4

APPENDIX A

ACOUSTIC TERMINOLOGY & HUMAN RESPONSE TO BROADBAND SOUND

1.1 Acoustic Terminology

The human impact of sounds is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and variation in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

Sound	Vibrations propagating through a medium (air, water, etc.) that are detectable by the auditory system.
Noise	Sound that is unwanted by or disturbing to the perceiver.
Frequency	The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.
dB(A):	Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the 'A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated 'A' weighted sound level is designated as dB(A) or L_A.
L_{eq} :	A notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc). The concept of L_{eq} (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction. Because L_{eq} is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.
L_{10} & L_{90} :	Statistical L_n indices are used to describe the level and the degree of fluctuation of non-steady sound. The term refers to the level exceeded for n% of the time. Hence, L_{10} is the level exceeded for 10% of the time and as such can be regarded as a typical maximum level. Similarly, L_{90} is the typical minimum level and is often used to describe background noise. It is common practice to use the L_{10} index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.
L_{max} :	The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged L_{eq} value.

1.2 Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000

1.3 Human Perception of Broadband Noise

APPENDIX A

ACOUSTIC TERMINOLOGY & HUMAN RESPONSE TO BROADBAND SOUND

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

INTERPRETATION

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

1.4 Earth Bunds and Barriers - Effective Screen Height

When considering the reduction in sound level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a tall barrier exists between a sound source and a listener, with the barrier close to the listener, the listener will perceive the sound as being louder if he climbs up a ladder (and is closer to the top of the barrier) than if he were standing at ground level. Equally if he sat on the ground the sound would seem quieter than if he were standing. This is explained by the fact that the "effective screen height" is changing with the three cases above. In general, the greater the effective screen height, the greater the perceived reduction in sound level.

Similarly, the attenuation provided by a barrier will be greater where it is aligned close to either the source or the listener than where the barrier is midway between the two.

APPENDIX B
AS10099 - UCL, IoE, 20 Bedford Way, London
Plant Noise Assessment

Royal National Hotel

AHU

Night-time		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
AHU FAI	L_w	67	70	55	48	47	46	42	40	**57**
Bend (1400mm)		-1	-4	-6	-4	-4	-4	-4	-4	
Sound Power at Grille	L_w	**66**	**66**	**49**	**44**	**43**	**42**	**38**	**36**	**53**
Propagation Correction (Quarter)		-5	-5	-5	-5	-5	-5	-5	-5	
Distance Loss	64m	-36	-36	-36	-36	-36	-36	-36	-36	
Directivity		-1	-5	-8	-8	-7	-7	-7	-7	
Screening*		-16	-19	-20	-20	-20	-20	-20	-20	
Specific Noise Level at Receiver	L_{eq}	**8**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**7**

**screening loss limited to 20dB*

AHU

Night-time		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
AHU Exhaust Outlet	L_w	65	76	67	64	61	61	58	56	**68**
Rectangular Duct (450 - 900mm) - 10.5m		-6	-4	-3	-1	-1	-1	-1	-1	
Bend (1000mm)		-1	-4	-6	-4	-4	-4	-4	-4	
Rectangular Duct (450 - 900mm) - 6.5m		-4	-3	-2	-1	-1	-1	-1	-1	
Sound Power at Grille	L_w	**54**	**65**	**56**	**58**	**55**	**55**	**52**	**50**	**62**
Propagation Correction (Quarter)		-5	-5	-5	-5	-5	-5	-5	-5	
Distance Loss	71m	-37	-37	-37	-37	-37	-37	-37	-37	
Directivity		-1	-5	-8	-8	-7	-7	-7	-7	
Screening*		-14	-17	-20	-20	-20	-20	-20	-20	
Specific Noise Level at Receiver	L_{eq}	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**7**

MVHR

Night-time		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
MVHR FAI	L_w	72	65	59	58	55	43	30	30	**59**
Bend (330mm)		0	0	-1	-4	-6	-4	-4	-4	
Rectangular Duct (300 - 450mm) - 7.8m		-8	-5	-2	-2	-2	-2	-2	-2	
Rectangular Duct (300 - 450mm) - 1.6m		-2	-1	0	0	0	0	0	0	
Bend (330mm)		0	0	-1	-4	-6	-4	-4	-4	
Sound Power at Grille	L_w	**63**	**58**	**54**	**48**	**41**	**33**	**20**	**20**	**50**
Propagation Correction (Quarter)		-5	-5	-5	-5	-5	-5	-5	-5	
Distance Loss	93m	-39	-39	-39	-39	-39	-39	-39	-39	
Directivity		-1	-1	-3	-7	-8	-8	-8	-8	
Screening*		-12	-14	-17	-20	-20	-20	-20	-20	
Specific Noise Level at Receiver	L_{eq}	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**7**

MVHR

Night-time		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
MVHR Exhaust Outlet	L_w	75	74	75	73	71	68	67	63	**76**
Rectangular Duct (300 - 450mm) - 1.0m		-1	-1	0	0	0	0	0	0	
Rectangular Duct (300 - 450mm) - 0.6m		-1	0	0	0	0	0	0	0	
Sound Power at Grille	L_w	**73**	**73**	**75**	**73**	**71**	**68**	**67**	**63**	**76**
Propagation Correction (Eighth)		-2	-2	-2	-2	-2	-2	-2	-2	
Distance Loss	94m	-39	-39	-39	-39	-39	-39	-39	-39	
Directivity		-1	-1	-3	-7	-8	-8	-8	-8	
Screening*		-11	-14	-17	-20	-20	-20	-20	-20	
Specific Noise Level at Receiver	L_{eq}	**20**	**16**	**14**	**5**	**1**	**0**	**0**	**0**	**10**

Total Specific Noise Level at Receiver	$L_{eq\ 1hr}$	**20**	**17**	**14**	**8**	**6**	**6**	**6**	**6**	**14**

Night-time Criterion 39 dB(A)