clarke saunders | **acoustics**

specialist consultants

REPORT AS7143.150820.NIA.1.1

UCLH PHASE 4
TEMPORARY VACUUM INSULATED EVAPORATOR

NOISE IMPACT ASSESSMENT

Prepared: 02 September 2015

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List of Attachments

1.0 INTRODUCTION

This report has been prepared to support the retrospective planning application for the installation of temporary Vacuum Insulated Evaporator (VIE) plant to the rear of the former Student Union building on Huntley Street.

The assessment of the noise impact of the VIE is in accordance with the London Borough of Camden's standard planning requirements.

This report describes the assessment undertaken utilising background noise data collected at the site and noise data measured close-to the installed plant.

2.0 PLANNING REQUIREMENTS

The measures against which to assess the equipment have been drawn from the requirements of UCLH Phase 4 permission. This primarily includes Conditions 29 and 24. It is assumed that London Borough of Camden will seek similar levels of noise to be achieved. By way of reference, Condition 29 of the PBT Unit consent requires that;

> *Prior to the relocation of the vacuum insulated evaporator, an acoustic report shall be submitted to and approved by the Local Planning Authority detailing how the required noise criteria as outlined within condition 24 will be met. Any attenuation measures detailed within the acoustic report approved by the Local Planning Authority shall be installed and remain in place for the lifetime of the development.*

> *On commissioning the machinery and prior to the building being occupied a noise survey shall be carried out to ascertain the above noise levels criteria from the machinery are being met. An acoustic report shall be submitted for the approval of the Local Planning Authority. The Acoustic Report shall clearly contain map/plan showing all measurements locations, tabulated and graphically raw data, calculations/façade corrections/assumptions made, time date, etc.*

(ii) All plant and machinery, and ventilation ducting shall be installed so as to prevent the transmission of noise and vibration within or at the boundary of any noise sensitive premises either attached to or in the vicinity of the premises to which this application refers.

Condition 24 of the PBT Unit consent, as referenced by Condition 29, requires that;

> *Noise levels at a point 1 metre external to sensitive facades shall be at least 5dB(A) less than the existing background measurement (L_{A90}), expressed in dB(A) when all plant/equipment are in operation. Where it is anticipated that any plant/equipment will have a noise that has a distinguishable, discrete continuous note (whine, hiss, screech, hum) and/or if there are distinct impulses (bangs, clicks, clatters, thumps) special attention should be given to reducing the noise levels from that piece of plant/equipment at any sensitive façade to at least 10dB(A) below the L_{A90}, expressed in dB(A).*

3.0 ENVIRONMENTAL NOISE SURVEY

The temporary VIE is located on Shropshire Place, to the rear of the former Student Union building on Huntley Street. Refer to figure AS7148/SP3.

From inspection of the site, the nearest noise sensitive facades appear to be those of apartments overlooking Huntley Street to the south of the Student Union Building. There are no residential windows overlooking the VIE installation.

3.1 Survey Procedure & Equipment

A survey of the existing background noise levels was undertaken on the flat roof of the Student Union building overlooking Huntley Street, as shown in site plan AS7143/SP3. The VIE was heavily screened from this location and was deemed to be inaudible as a result. Measurements of consecutive 5-minute L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} spectral sound pressure levels were taken between 15:05 hours on Friday 14th August 2015 and 12:50 hours on Wednesday 19th August 2015.

These measurements allow suitable noise criteria to be set for the new building services plant, dependent on hours of operation.

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

- 1 no. Norsonic data logging sound level meter type 118;
- 1 no. GRAS environmental microphone type 41AL;
- 1 no. Norsonic sound level calibrator type 1251.

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

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

Measurements were made generally in accordance with ISO 1996-2:2007 *Acoustics - Description, measurement and assessment of environmental noise* Part 2: *Determination of environmental noise levels*.

3.2 Survey Results

The ambient noise climate at the receptor location is determined by road traffic on distant streets. Huntley Street itself carries little traffic.

Figures AS7143/TH3-TH7 show the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels as time histories at the measurement position. The results are summarised below.

Parameter	Period	Monitor Location
Average Noise Level, dB L_{Aeq}	Daytime (07:00 – 23:00)	58
	Night (23:00 – 07:00)	53
Typical Lowest Background Noise Level, dB L_{A90}	Daytime (07:00 – 23:00)	52
	Night (23:00 – 07:00)	51

Table 3.1 – Summary of environmental noise survey results **[dB re 20 µPa]**

4.0 ASSESSMENT CRITERIA

From assessment of sound levels measured around the VIE plant, tonal noise has not been found to be a characteristic of the plant. The plant noise emissions criteria that should not be exceeded at the nearest noise sensitive receiver, as defined by Condition 24, are detailed in Table 4.1.

Daytime (07:00 – 20:00 hours)	Night (2300 – 07:00 hours)
L_{Aeq} 47 dB	L_{Aeq} 46 dB

Table 4.1 - Proposed design noise criteria **[dB ref. 20µPa]**

5.0 PREDICTED NOISE IMPACT

5.1 Installed plant

Noise from the VIE installation has been measured from the flat roof at the rear of the Student Union building in the general direction of the sensitive facades. The measured values are shown in Table 5.1.

Freq (Hz)	63	125	250	500	1000	2000	4000	8000	dB(A)
L_{eq}, dB	66	71	68	61	60	63	60	61	69

Table 5.1 – VIE sound level, L_{eq} @ 6m **[dB ref. 20µPa]**

5.2 Predicted noise levels

This data has been extrapolated for distance to the nearest sensitive windows as well as intervening screening and reflection effects, as shown in Appendix B.

The effect of this at the sensitive windows has been assessed in Table 5.2.

	Daytime **07.00h – 23.00h**	Night-time 23.00h – 07.00h
Plant noise level, dB L_{Aeq}	42	42
Background sound level, dB L_{A90}	52	51
Difference, dB	-10	-9

Table 5.2 – Assessment of VIE

Expected sound levels from the temporary VIE are more than 5dB below the daytime and night-time background levels and would, consequently, be compliant with Camden's typical requirements.

6.0 CONCLUSION

Clarke Saunders Associates has undertaken an assessment of the noise impact of the temporary Vacuum Insulated Evaporator (VIE) located at the rear of the former Student Union building on Huntley Street as part of the UCLH Proton Beam Therapy (PBT) Unit development.

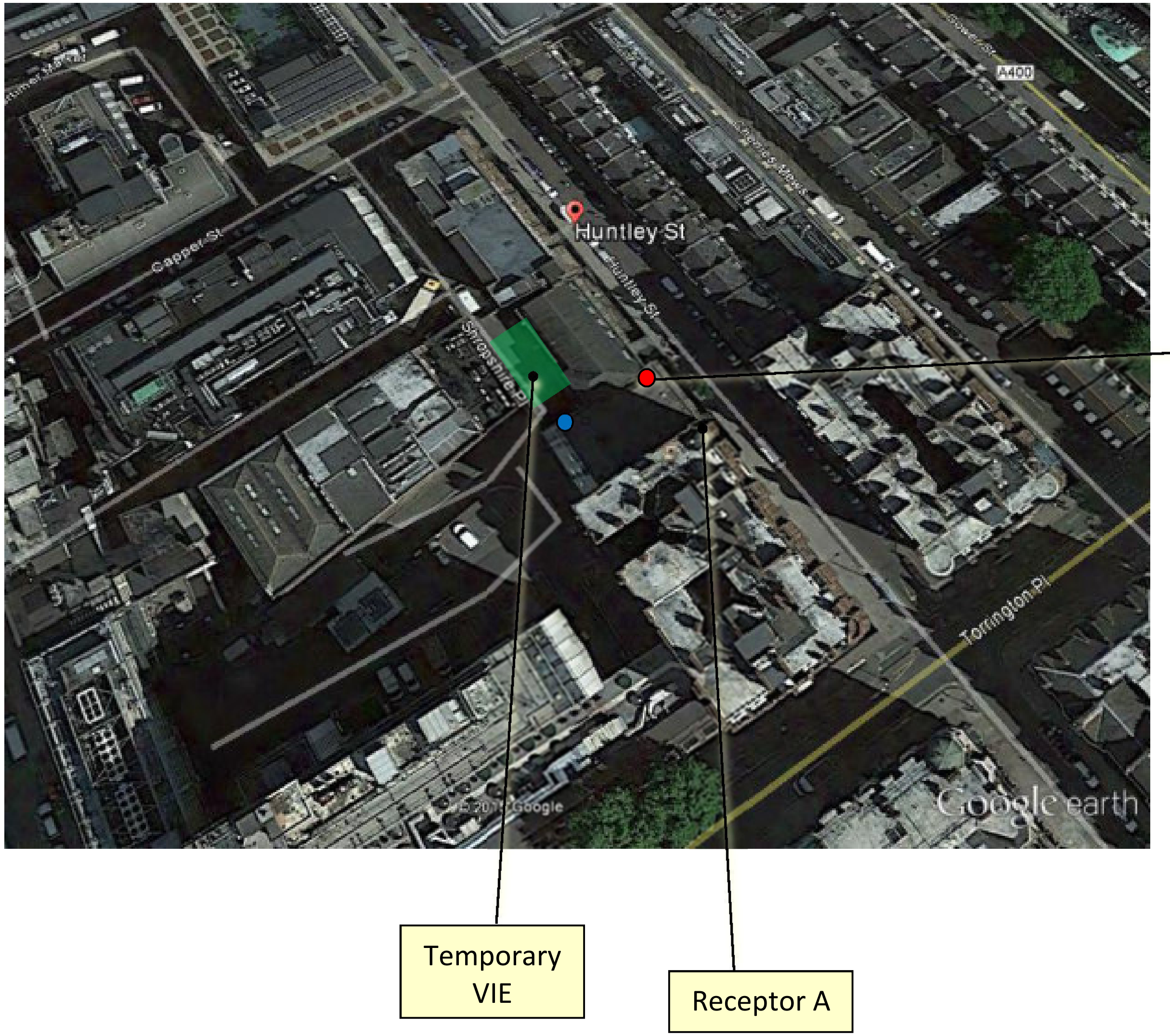
Environmental noise monitoring undertaken close to the nearest affected residential premises has enabled assessment criteria for plant noise emissions to be set in accordance with Camden Council's standard requirements.

Compliance with the noise emissions criteria has been demonstrated for operation of the temporary VIE.

p.p.

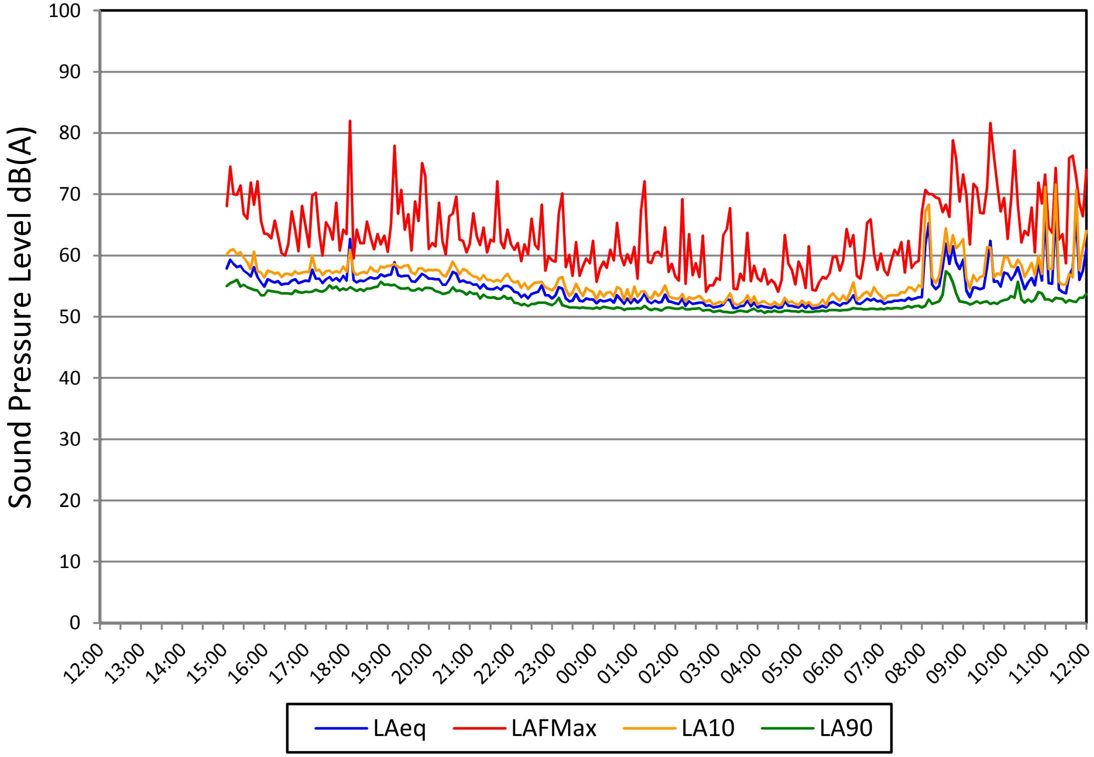
Matt Sugden MIOA

CLARKE SAUNDERS ASSOCIATES


N
Monitor
Sample
Huntley St
Capper St
Torrington Pl
A400
Google earth
Monitor A
Temporary VIE
Receptor A

UCLH Phase 4 Temporary VIE

Environmental Noise Time History: Huntley Street

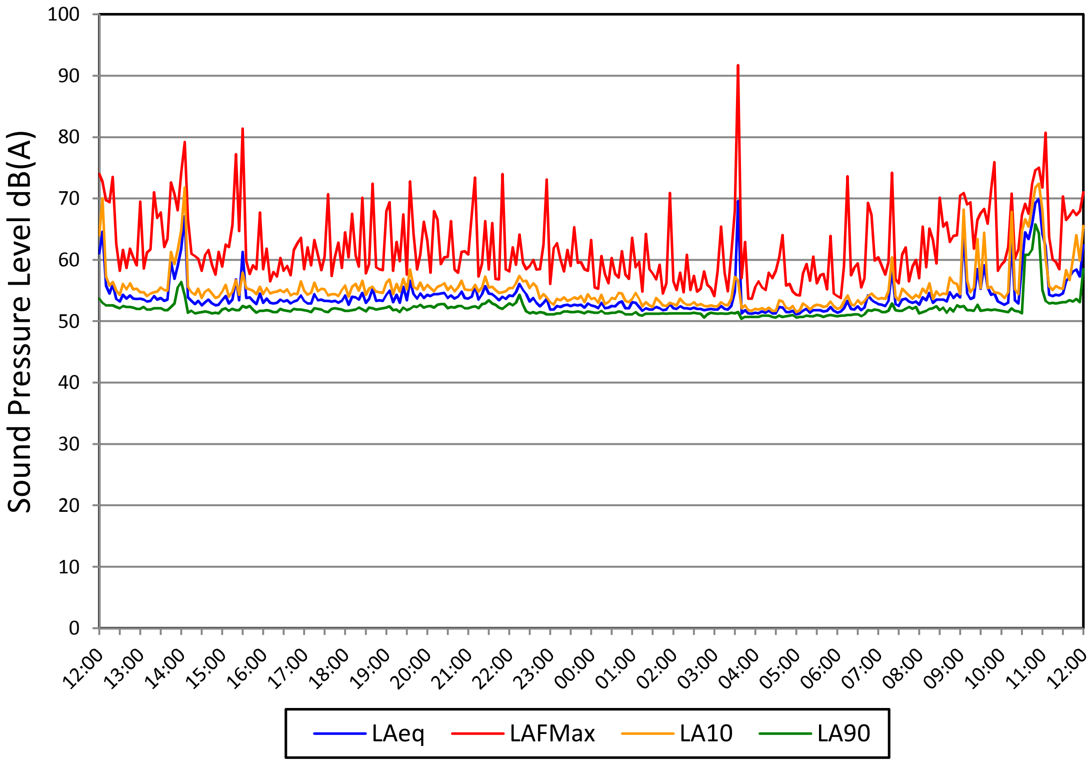


Friday 14 August to Saturday 15 August 2015

Figure AS7143/TH3

UCLH Phase 4 Temporary VIE

Environmental Noise Time History: Huntley Street

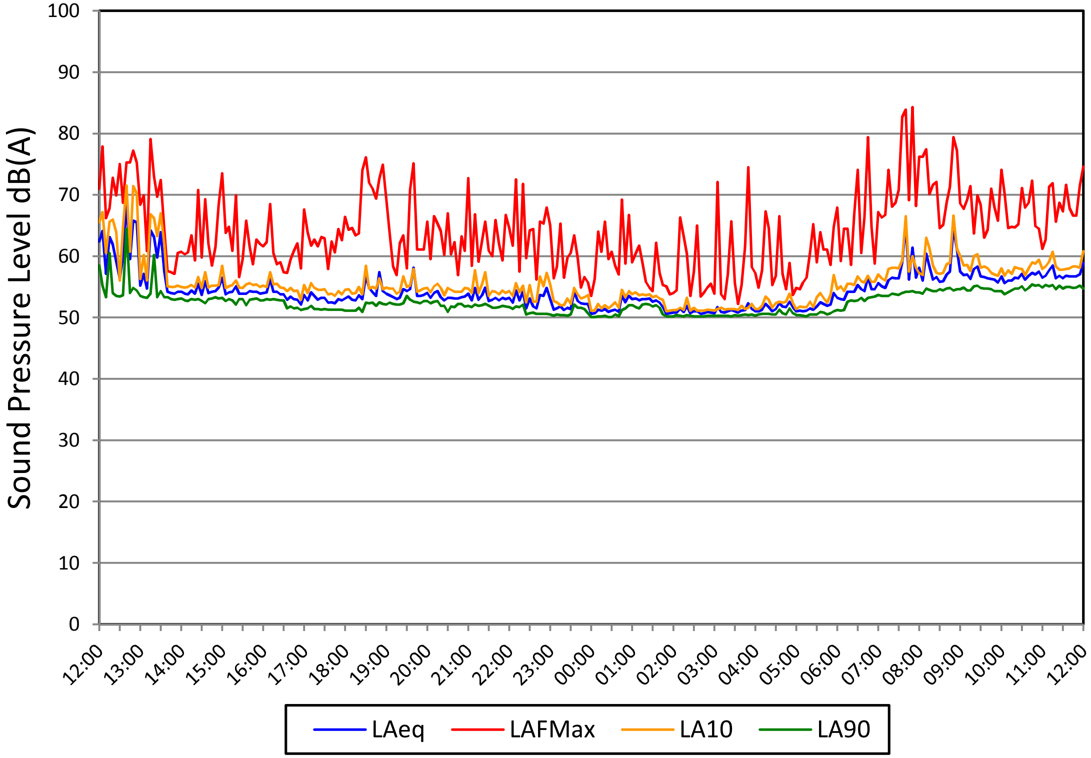


Saturday 15 August to Sunday 16 August 2015

Figure AS7143/TH4

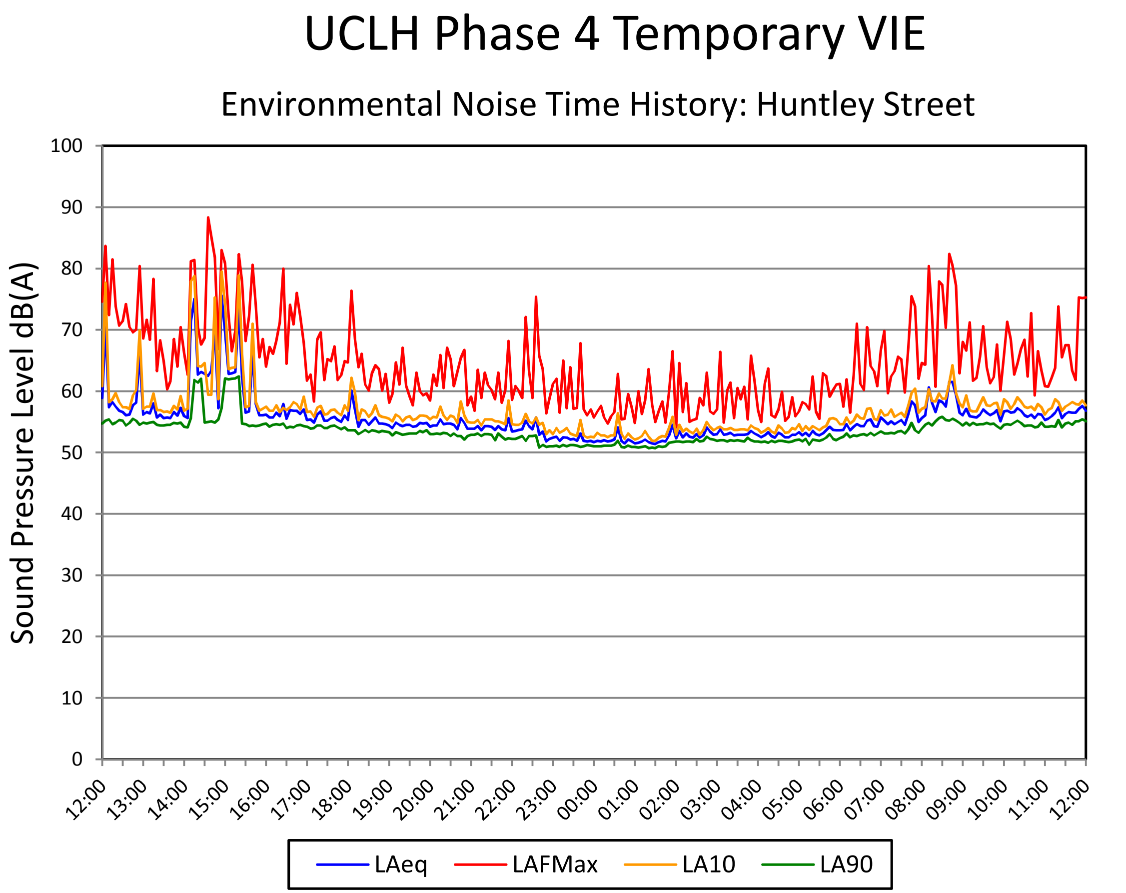
UCLH Phase 4 Temporary VIE

Environmental Noise Time History: Huntley Street



Sunday 16 August to Monday 17 August 2015

Figure AS7143/TH5



Monday 17 August to Tuesday 18 August 2015

Figure AS7143/TH6

APPENDIX A

ACOUSTIC TERMINOLOGY & HUMAN RESPONSE TO BROADBAND NOISE

1.1 Acoustic Terminology

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

dB (A): The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level.

L_{10} & L_{90}: If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and 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 the `average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.

It is common practice to use the L_{10} index to describe traffic noise, as being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic noise.

L_{eq}: The concept of L_{eq} (equivalent continuous sound level) has up to recently been primarily used in assessing noise in industry but seems now to be finding use in defining many other types of noise, such as aircraft noise, environmental noise and construction noise.

L_{eq} is defined as 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 use of digital technology in sound level meters now makes the measurement of L_{eq} very straightforward.

Because L_{eq} is effectively a summation of a number of noise events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute noise limit.

L_{max}: L_{max} is the maximum sound pressure level recorded over the period stated. L_{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L_{eq} noise level.

D The sound insulation performance of a construction is a function of the difference in noise level either side of the construction in the presence of a loud noise source in one of the pair of rooms under test. *D*, is therefore simply the *level difference* in decibels between the two rooms in different frequency bands.

D_w D_w is the *Weighted Level Difference* The level difference is determined as above, but weighted in accordance with the procedures laid down in BS EN ISO 717-1.

$D_{nT,w}$ $D_{nT,w}$ is the *Weighted Standardised Level Difference* as defined in BS EN ISO 717-1 and represents the *weighted level difference*, as described above, corrected for room reverberant characteristics.

C_{tr} C_{tr} is a spectrum adaptation term to be added to a single number quantity such as $D_{nT,w}$, to take account of characteristics of a particular sound.

$L'_{nT,w}$ $L'_{nT,w}$ is the *Weighted Standardised Impact Sound Pressure Level* as defined in BS EN ISO 717-2 and represents the level of sound pressure when measured within room where the floor above is under excitation from a calibrated tapping machine, corrected for the receive room reverberant characteristics.

APPENDIX A

ACOUSTIC TERMINOLOGY & HUMAN RESPONSE TO BROADBAND NOISE

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 have 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, eg. 250 Hz octave band runs from 176 Hz to 353 Hz. The most commonly used bands are:

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

1.3 Human Perception of Broadband Noise

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

INTERPRETATION

Change in Sound Level dB(A)	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 noise level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a 3 metre high barrier exists between a noise source and a listener, with the barrier close to the listener, the listener will perceive the noise source is 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 noise source would seem quieter than it was if he were standing. This may be explained by the fact that the "effective screen height" is changing with the three cases above, the greater the effective screen height, in general, the greater the reduction in noise level.

Where the noise sources are various roads, the attenuation provided by a fixed barrier at a specific property will be greater for roads close to the barrier than for roads further away.

AS7143 UCLH PHASE 4: TEMPORARY VACUUM INSULATED EVAPORATOR

APPENDIX B

ACOUSTIC CALCULATIONS

			63	125	250	500	1k	2k	4k	8k	dB(A)
Sound level on SU flat roof ~6m from plant		dB	66	71	68	61	60	63	60	61	69
Distance from plant to receptor	26	m									
Distance loss		dB	-13	-13	-13	-13	-13	-13	-13	-13	
Screening fromSU building flat roof parapet		dB	-11	-13	-16	-18	-18	-18	-18	-18	
Reflection effects		dB	3	3	3	3	3	3	3	3	
Received level		dB	45	48	42	33	32	36	33	33	42