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LEE HOUSE & CHURCHGATE HOUSE, MANCHESTER

NOISE IMPACT ASSESSMENT

Report **11215-NIA-02**

Prepared on 16 August 2019

Issued For:

Helical (Churchgate) Limited

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1.0 INTRODUCTION

Clement Acoustics Ltd has been commissioned by Helical (Churchgate) Limited to measure existing background noise levels at Lee House, Manchester. Measured noise levels will be used to determine noise emission criteria for a proposed plant installation in agreement with the planning requirements of the Local Authority.

This report presents the results of the environmental survey followed by noise impact calculations and outlines any necessary mitigation measures.

2.0 SITE DESCRIPTION

Latest proposals are to install a number of internal ventilation heat recovery units with office spaces at Lee House and Churchgate House, with atmospheric terminations routed to an enclosed courtyard area surrounded by offices.

An earlier application at Lee House has previously been assessed, to relocate and replace a number of air conditioning condenser units, to be located on the main roof of Lee House.

This assessment will consider the cumulative effects of the currently proposed heat recovery units, and the previously assessed air conditioning units.

The proposed plant location is in a mixed commercial and residential area. The closest residential window to the proposed plant location is at a minimum distance of 20 m south of the Lee House main roof plant location.

3.0 ENVIRONMENTAL NOISE SURVEY

3.1 Procedure

Measurements were undertaken at 2 positions shown in Site Plan 11215-SP2. The choice of these positions was based both on accessibility and on collecting representative noise data in relation to the surrounding area.

Continuous automated monitoring was undertaken for the duration of the survey between 15:00 on 18 May 2016 and 15:00 on 20 May 2016.

Noise levels at the monitoring position were dominated by existing plant with some contribution from surrounding roads.

Weather conditions were generally dry with light winds, therefore suitable for the measurement of environmental noise.

The measurement procedure generally complied with BS7445:1991. *Description and measurement of environmental noise, Part 2- Acquisition of data pertinent to land use*.

3.2 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed.

The equipment used was as follows.

- 1 No. Svantek Type 977 Class 1 Sound Level Meter,
- 1 No. Svantek Type 971 Class 1 Sound Level Meter.

4.0 RESULTS

The $L_{Aeq: 5min}$, $L_{Amax: 5min}$, $L_{A10: 5min}$ and $L_{A90: 5min}$ acoustic parameters were measured at the location shown in Site Plan 11215-SP2. The measured levels are shown as time histories in Figures 11215-TH1-2.

Minimum background levels are shown in Table 4.1.

	Average background noise level $L_{A90: 5min}$ dB(A)	Minimum background noise level $L_{A90: 5min}$ dB(A)
Position 1		
Daytime [*07:00 - 23:00*]	60	50
Night-time [*23:00 - 07:00*]	55	46
Position 2		
Daytime [*07:00 - 23:00*]	60	49
Night-time [*23:00 - 07:00*]	56	46

Table 4.1: Minimum background noise levels

As shown in 11215-TH1, certain periods at Position 1 are dominated by constant plant noise, while 11215-TH2 demonstrates that noise from the plant to be relocated is not constant in nature. This suggests that other plant installations close to the site are affecting the noise levels close to Position 1.

Examination of the noise data at Position 1 suggests that the dominant plant installations are operational between 06:00 and 18:00. In order to set sufficiently robust criteria for residential receivers, the minimum daytime noise levels at either position will be used.

This is considered particularly robust as plant units are for commercial use and time history 11215-TH2 demonstrates that the noise emissions of the relocated plant are significantly quieter during evening hours.

5.0 NOISE CRITERIA

In order to set the noise emission criterion such that suitable levels are achieved at noise sensitive receivers, we would recommend the following:

> *"The 'A' weighted sound pressure level from the plant, when operating at its noisiest, shall not at any time exceed a value of 10 dB below the external background noise, at a point 1 metre outside any window of any residential property."*

Based on results shown in table 4.1, we propose to set the noise criteria as 39 dB(A) in order to comply with the above requirement. Note that the criteria are based on minimum background daytime noise levels in order to present a more robust assessment.

6.0 DISCUSSION

6.1 Lee House Previous Application – Relocated and Removed Units

The relocated condenser units have been identified as follows:

- 6 No. Sanyo Eco i W-3Way Multi Units [*retained*],
- 4 No. Mitsubishi Mr Slim Units [*retained*],
- 5 No. Mitsubishi City Multi Units [*retained*],
- Total 10 No. Hitachi Units [*to be removed*],
- Total 3 No. Daikin Units [*to be removed*].

Due to the age of the installation, certain model numbers are not known and some units do not have technical information available.

The noise survey in Position 2 was therefore designed to capture noise emissions from the plant units in operation, for use in noise impact calculations.

The noise monitor at Position 2 was placed close to the Sanyo Eco (Capita 4th and 5th Floors), Mitsubishi City Multi (Manchester Growth Company 2nd Floor) and Hitachi (Odeon/UCI 7th Floor) Units. These units are significantly larger than other units and were observed to be the dominant source of noise emissions from the existing plant installation.

The monitoring position was a maximum of 3 m from the identified dominant noise sources.

A period of identified typical daytime plant operation as shown in 11215-TH2 has been assessed, with measured noise emissions as shown in Table 6.1.

	Measured Sound Pressure Level (dB) in each Frequency Band, at 3m							
Source	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Dominant Sources in Existing Plant Installation	69	67	59	58	55	49	45	41

Table 6.1: Measured Sound Pressure Levels

6.2 Lee House Previous Application – New Condenser Units

To replace the units identified as removed in Section 6.1, proposals were to install the following new units:

- 4 No. Mitsubishi PURY-EP450YLM-A1 Condenser Units

Noise emissions for the proposed plant units, as provided by the manufacturer, are shown in Table 6.2. Loudest modes of operation have been used in order to present a robust worst-case assessment.

	Sound Pressure Levels (at 1 meter, dB) in each Frequency Band								
Unit	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**	**dB(A)**
Mitsubishi PURY-EP450YLM-A1 Condenser Unit	73	70	65	61	56	51	47	41	63

Table 6.2: Manufacturer noise emissions levels

The new units will replace the removed units in the same location, identified as 'Proposed Plant Location' on the attached site plan.

6.3 New Application – Proposed Ventilation Units

Current proposals are to install a number of heat recovery units to service office spaces over 4th and 5th floors of Lee House, and on the 5th floor of Churchgate House.

All heat recovery units have been selected as Mitsubishi LGH100RVX-E Lossnay Units. Manufacturer noise emission data is only available as whole unit noise breakout levels, as shown in Table 6.3.

	Sound Pressure Levels (at 1.5 m, dB) in each Frequency Band								
Unit	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**	**dB(A)**
Mitsubishi LGH100RVX-E Lossnay Breakout Levels	53	45	40	36	32	25	17	10	38

Table 6.3: Manufacturer noise emissions levels

In the absence of any available induct data, it will be assumed that the stated whole unit breakout levels could be apparent at all atmospheric duct terminations.

The total number of atmosphere ducts is summarised as follows:

- Lee House 4th Floor:
  - 3 Heat Recovery Units, total of 6 atmospheric ducts,
- Lee House 5th Floor:
  - 3 Heat Recovery Units, total of 6 atmospheric ducts,
- Churchgate House 5th Floor:
  - 13 Heat Recovery Units, total of 26 atmospheric ducts.

6.4 Noise Impact Assessment

All retained and proposed condenser units will be located on a gantry, proposed in the location identified on the attached site plan.

The proposed plant location is a minimum of 20 m from identified residential windows, located to the south, as also shown in the site plan.

A 1.5 m parapet wall at the roof edge will provide a reasonable amount of screening to noise emissions, based on relative source and receiver heights.

In order to provide a particularly robust assessment, calculations have considered the source noise from all existing plant units (including those to be removed) and proposed plant units.

This is considered particularly robust as a number of the removed units were observed to be dominant sources of noise in the existing installation.

For the Heat Recovery Units, these all duct into a central courtyard area, enclosed by Lee House and Churchgate House. The building envelope of Lee House and Churchgate House will provide a significant amount of screening attenuation to the identified residential receiver, in combination with the minimum observed distance separation of 30 m.

Taking into account all necessary acoustic corrections including corrections for distance and screening, the resulting noise level at the nearest residential window would be as shown in Table 6.4. Detailed calculations are shown in Appendix B.

Receiver	Daytime Criterion	Noise Level at Receiver [*due to cumulative plant levels*]
Nearest Residential Window	39 dB(A)	39 dB(A)

Table 6.4: Noise levels and criteria at receiver

As shown in Table 6.4 and Appendix B, the proposed plant installation would be expected to meet the set criterion, based on the relocation and proposed installation of new units.

It should be noted that the assessment considers the effects of measured office hours plant noise levels impacting on the residential windows during evening hours, which presents a particularly robust assessment.

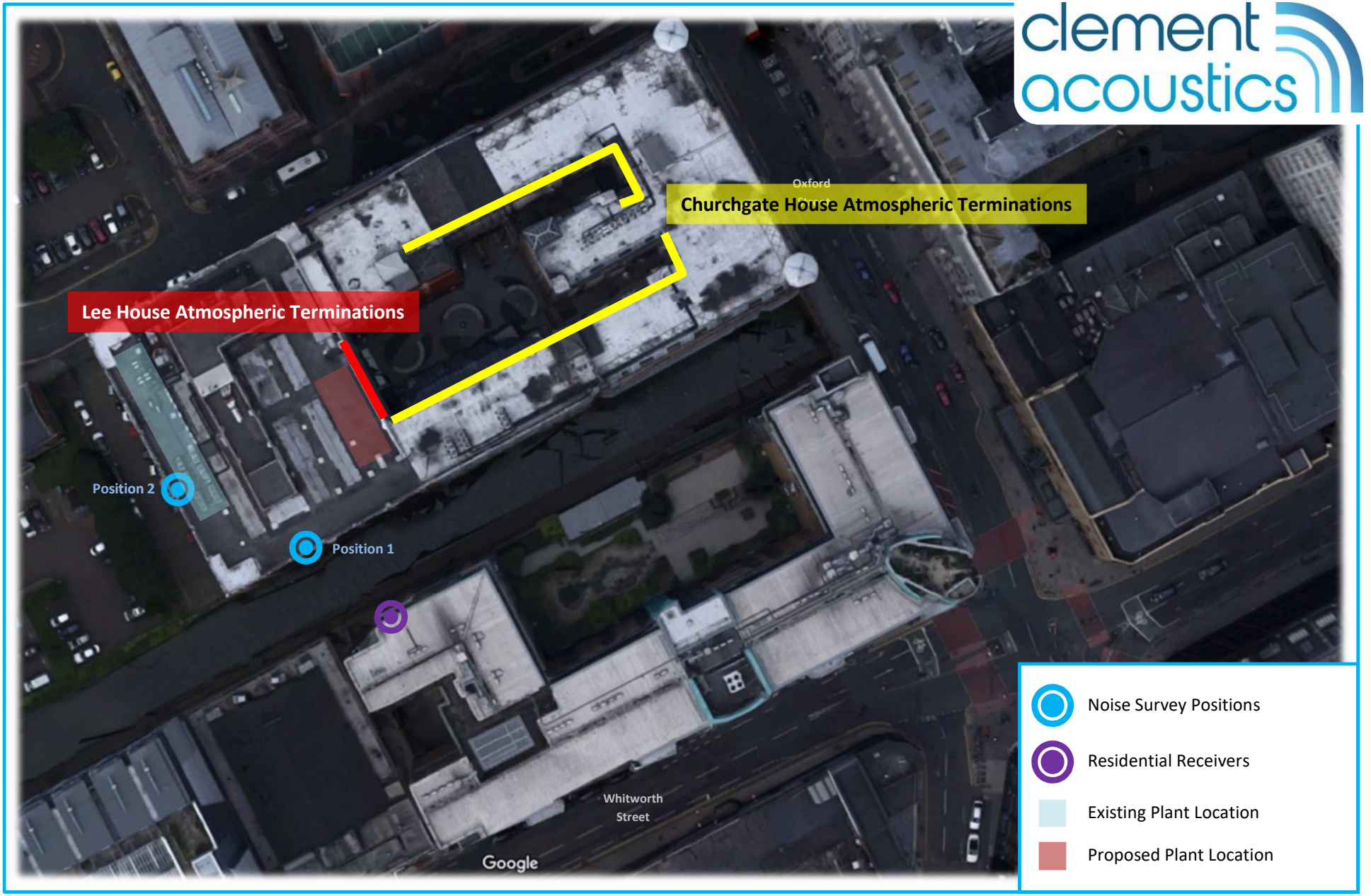
7.0 CONCLUSION

An environmental noise survey has been undertaken at Lee House, Manchester. The results of the survey have enabled criteria to be set for noise emissions from the relocated and proposed plant in order to protect the amenity of nearby residential receivers.

A noise impact assessment has then been undertaken using measured and manufacturer provided noise emissions to predict the noise levels due to the recent and current proposals at nearby noise sensitive receivers.

Calculations show that noise emissions from the relocated and proposed plant units would meet the set requirements.

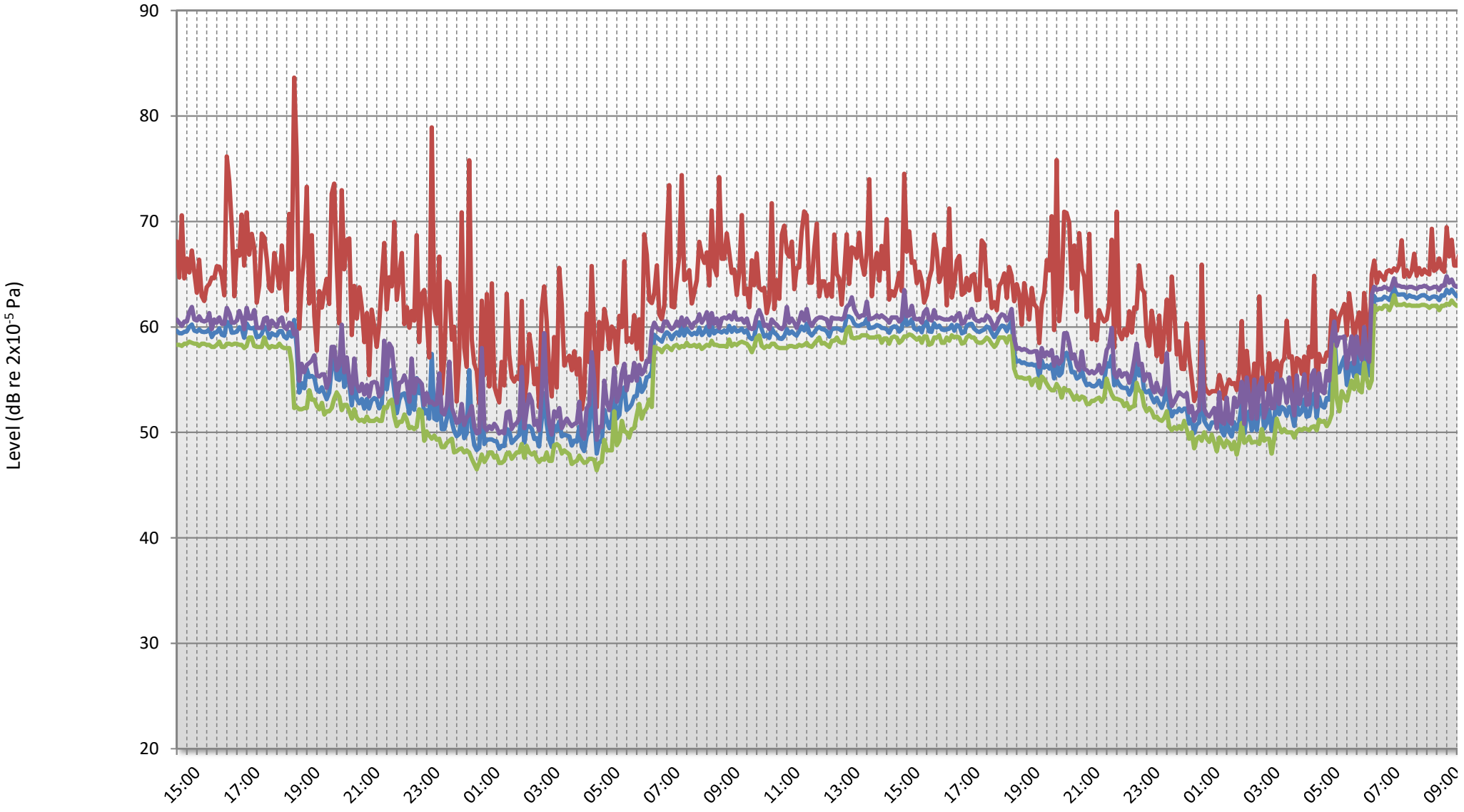
Report by	Checked by
Duncan Martin MIOA	**Florian Clement MIOA**



11215-SP2 Indicative site plan indicating noise monitoring position and nearest noise sensitive receiver **Date:** 16 August 2019

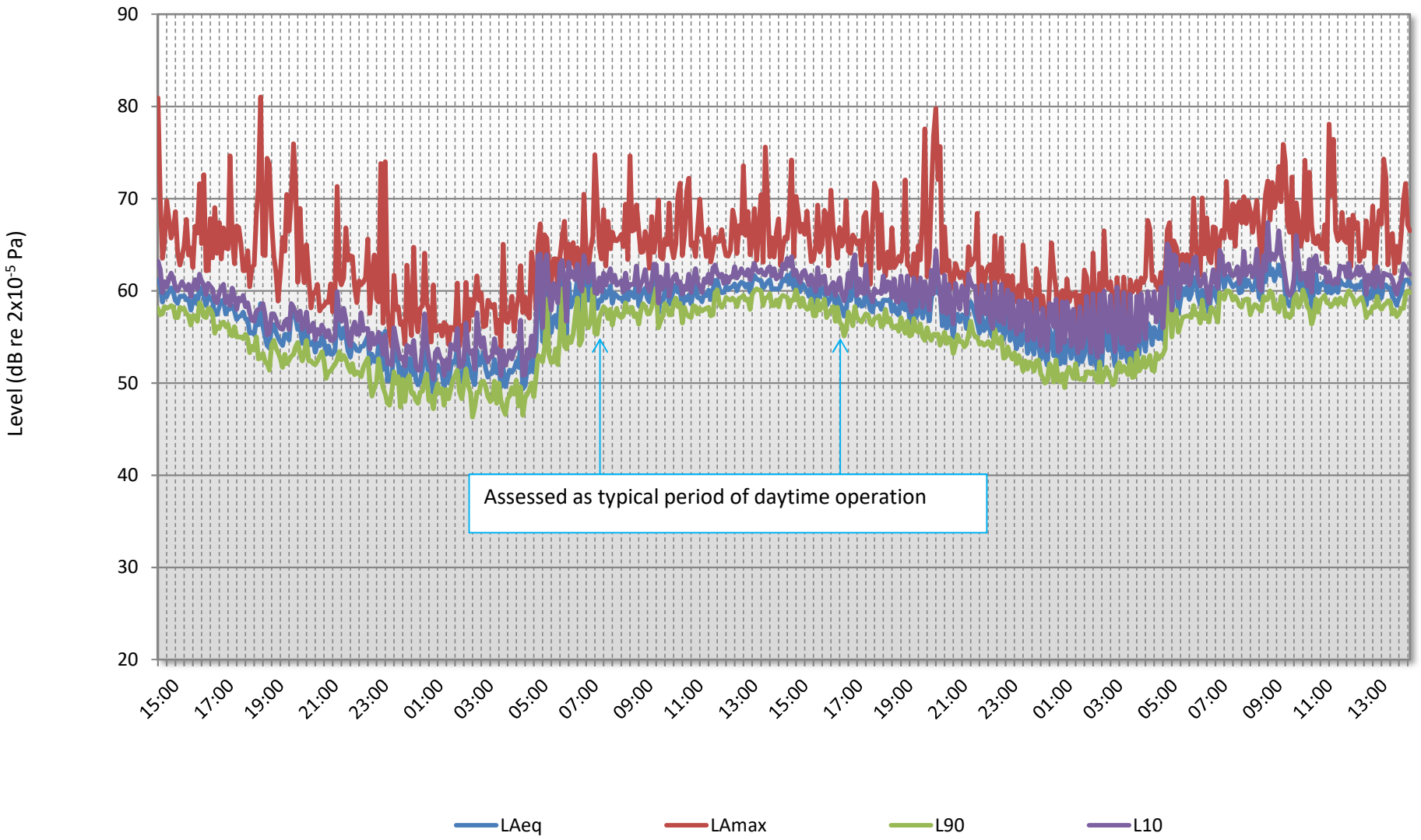
Lee House, Manchester (Position 1)

Environmental Noise Time History
18/05/16 to 20/05/16



Lee House, Manchester (Position 2)

Environmental Noise Time History
18/05/16 to 20/05/16



APPENDIX A

GLOSSARY OF ACOUSTIC TERMINOLOGY

dB(A)

The human ear is less sensitive to low (below 125Hz) and high (above 16kHz) frequency sounds. A sound level meter duplicates the ear's variable sensitivity to sound of different frequencies. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter. Measurements of sound made with this filter are called A-weighted sound level measurements and the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for not more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise

L_{90}

This is the level exceeded for not more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 10 such octave bands whose centre frequencies are defined in accordance with international standards.

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than one alone and 10 sources produce a 10dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Sound intensity is not perceived directly at the ear; rather it is transferred by the complex hearing mechanism to the brain where acoustic sensations can be interpreted as loudness. This makes hearing perception highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a reasonable guide to help explain increases or decreases in sound levels for many acoustic scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud
20	About 4 times as loud

Barriers

Outdoor barriers can be used to reduce environmental noises, such as traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and its construction.

Reverberation control

When sound falls on the surfaces of a room, part of its energy is absorbed and part is reflected back into the room. The amount of reflected sound defines the reverberation of a room, a characteristic that is critical for spaces of different uses as it can affect the quality of audio signals such as speech or music. Excess reverberation in a room can be controlled by the effective use of sound-absorbing treatment on the surfaces, such as fibrous ceiling boards, curtains and carpets.

APPENDIX B

11215

Lee House & Churchgate House, Manchester

EXTERNAL PLANT NOISE EMISSIONS CALCULATION

Receiver: Nearest Residential Receiver
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Measured sound pressure level close to dominant sources of noise									
Existing Plant Installation	69	67	59	58	55	49	45	41	60
Source noise a maximum of 3m from dominant sources									
Attenuation from parapet wall, dB	-3	-5	-7	-10	-11	-14	-15	-15	
Distance correction to receiver, dB (total distance 20m)	-16	-16	-16	-16	-16	-16	-16	-16	
Sound pressure level at receiver due to existing plant units	**50**	**46**	**36**	**32**	**28**	**19**	**14**	**10**	**35**
Manufacturer provided sound pressure levels at 1m									
Mitusbishi PURY-EP450YLM-A1 Condenser Unit	73	70	65	61	56	51	47	41	63
Correction for number of units (4), dB	6	6	6	6	6	6	6	6	
Correction for reflections, dB	3	3	3	3	3	3	3	3	
Attenuation from parapet wall, dB	-3	-5	-7	-10	-11	-14	-15	-15	
Distance correction to receiver, dB (total distance 20m)	-26	-26	-26	-26	-26	-26	-26	-26	
Sound pressure level at receiver due to proposed plant units	**53**	**48**	**41**	**34**	**28**	**20**	**15**	**9**	**37**
Manufacturer provided sound pressure levels at 1.5m									
Mitusbishi LGH100RVX-E Lossnay Unit	53	45	40	36	32	25	17	10	38
Correction for total number of atmospheric ducts (38), dB	16	16	16	16	16	16	16	16	
Correction for reflections, dB	6	6	6	6	6	6	6	6	
Attenuation from intermediate building envelope, dB	-5	-7	-10	-12	-15	-18	-18	-18	
Distance correction to receiver, dB (total distance 30m)	-26	-26	-26	-26	-26	-26	-26	-26	
Sound pressure level at receiver due to proposed plant units	**44**	**34**	**26**	**20**	**13**	**3**	**-5**	**-12**	**24**
Cumulative sound pressure level at receiver due to all units	**55**	**50**	**42**	**36**	**31**	**22**	**18**	**13**	**39**

Design Criterion	**39**

BS 8233 ASSESSMENT CALCULATION

Receiver: Inside Nearest Residential Window
Source: Proposed plant installation

	Frequency, Hz								
	63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*	*dB(A)*
Sound pressure level outside window	55	50	42	36	31	22	18	13	39
Minimum attenuation from façade with partially open window, dB	-15	-15	-15	-15	-15	-15	-15	-15	
Sound pressure level inside nearest noise sensitive premises	**40**	**35**	**27**	**21**	**16**	**7**	**3**	**0**	**24**

Design Criterion	**30**