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Our Ref: TP/EC10661_45513 Date: 17 March 2010

Project : UCL, Institute of Child Health, Wolfson Centre

BACKGROUND NOISE SURVEY AND PLANT ASSESSMENT

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REPORT

ENVIRONMENTAL EQUIPMENT CORPORATION

CONTENTS

1.00 INTRODUCTION

1.01 Environmental Equipment Corporation Limited have been commissioned by Fowler Martin Ltd to undertake a background noise survey at the Wolfson Centre Institute for Child Health, with a view to ascertaining prevailing background noise levels for the immediate vicinity.

1.02 Proposals are being submitted to the London Borough of Camden to convert the building into a UCL educational building including lecture theatres and offices. Included within the proposals is the installation of air conditioning and mechanical ventilation. Noise levels from the plant need to be assessed as part of the planning application and are therefore addressed in this report.

1.03 This report is prepared solely for Fowler Martin Ltd. Environmental Equipment Corporation Ltd accepts no responsibility for its use by any third party.

2.00 SITE

2.01 The Wolfson Centre is located on Mecklenburgh Square, at the eastern end of a large community sports field. The activities on the sports field can intermittently generate high levels of noise and thus it was deemed necessary to install mechanical ventilation (allowing windows to be kept closed) on this western side of the building. The eastern façade is overlooked by a quiet residential street and thus does not have any mechanical ventilation. Appendix A shows drawings of the proposed building layouts.

2.02 Due to the location of the proposed plant, only properties to the west of the Wolfson Centre need to be considered, the closest of which is a nursery school at a distance of 60m from the plant location. The nearest residential properties are university halls of residence at a distance of 170m from the plant location. The closest commercial property is at a distance of 130m. The aerial photograph below indicates the location of the Wolfson Centre and surrounding noise sensitive properties.

3.00 MEASUREMENTS

3.01 Background noise levels have been measured over a 24 hour period at a suitable location, representative of the immediate noise environment, as shown on the site plan in Appendix A.

3.02 The equipment was set up to integrate sound levels over 5 minute intervals for 24 hours between 1550hrs, Monday 15 March and 1540hrs, Tuesday 16 March 2010.

3.03 Levels were recorded as A weighted L_{eq}, L_{10} and L_{90}.

3.04 Weather conditions during the survey were calm and dry throughout.

4.00 EQUIPMENT

4.01 Equipment for the survey was as follows:-

- Brüel & Kjær type 2238 Integrating Sound Level Meter conforming to type 1 BS EN 60804 & BS EN 60651: 1994.
- Brüel & Kjær Condenser Microphone and Connecting Leads.
- Brüel & Kjær Outdoor Microphone Kit, type UA1404.
- Tripod.

4.02 The equipment holds current UKAS or equivalent accreditation and serial numbers as follows:

Sound Level Meter B&K2238	Serial No.	262287
	Calibration Date	28th August 2008
	Cal Certificate No.	C0806385
½" Condenser Mic. B&K4188	Serial No.	2641221
	Calibration Date	28th August 2008
	Cal Certificate No.	C0806385
Calibrator B&K4231	Serial No.	2389051
	Calibration Date	13 October 2009
	Cal. Certificate No.	C0908496

N.B. Copies of calibration certificates are available upon request.

4.03 The equipment was calibrated both before and after the survey with no difference noted in the levels.

5.00 RESULTS

5.01 A list of the levels measured is included in Appendix B and represented graphically in Appendix C.

5.02 A summary of the averaged ambient and lowest measured background levels is shown in Table 5.1, below.

Period	L_{Aeq} – dB	L_{A90} – dB
Day time (0700-1900 hrs)	59.7	48.5
Evening (1900-2300 hrs)	57.4	47.0
Night-time (2300-0700 hrs)	51.1	45.5

Table 5.1: Measured Ambient and Background Noise Levels

6.00 DISCUSSION

6.01 The London Borough of Camden Environmental Health Department require that noise levels generated by mechanical services plant should be designed to a level of 5 dB below the lowest measured background level during the proposed period of operation and as measured at the nearest noise sensitive windows.

6.02 Should the proposed plant have the potential to generate noise which is intermittent or tonal, a further 5 dB reduction in the design criterion applies. Based on the manufacturer's published noise data and previous experience the proposed plant is anticipated to be neither tonal nor intermittent. Therefore, based on the measured noise levels summarised in Table 5.1, the applicable criteria for this application will be 5 dB below the lowest background noise levels of 48.5, 47.0, and 45.5 dB(A) for the respective day, evening and night-time periods respectively.

6.03 It is proposed that plant will only operate during University teaching hours, limited to within 0700hrs-2300hrs, therefore, noise emitted from the proposed plant should not exceed 42 dB(A) at 1m external of the nearest residential window.

6.04 The above design criterion will also be used to assess the noise impact on the nearby nursery school. A plant noise limit of 42 dB(A) will ensure that the ambient noise level outside the nursery school (only in use during daytime hours) is not increased. Furthermore, should the nursery require open windows for ventilation the above limit adheres to the requirements of Building Bulletin 93; noise within schools.

7.00 PLANT ASSESSMENT

7.01 The proposed plant consists of 8 No mini air handling units and 5 No Daikin REYQ28 condensers. The plant is spread across two floors, but is all exhausted on the western façade with a direct line of sight to the nursery (the nearest and thus most affected noise sensitive property). The mini AHUs are extremely low noise and low air volume units designed to be used within noise sensitive teaching spaces, the fresh air inlet and exhaust terminations having a noise level of 30 dB(A) at 1m. The Manufacturer's published noise level for the REYQ28 Condenser is a Sound Power Level of 83 dB(A). The majority of this sound power is radiated by the exhaust fan which will be ducted to the back of a louvred screen on the building's façade. Therefore, as a worst case assumption the noise level from each heat pump is assumed to be 74 dB(A) at 1m (allowing for reflections from the façade).

7.02 Allowing for distance attenuation over 60 m, the cumulative plant noise level outside the windows of the nursery has been calculated to be 41 dB(A), as indicated below.

Element	Level	Comments
Cumulative Source Noise	81 dB(A)	Cumulative source @1m. 8 No AHUs and 5 No Condensers.
Distance Attenuation	- 36 dB	Hemispherical Spreading, 60m
Directivity	- 4 dB	Approximately 45 ° off-axis. Mid and high frequency beaming.
Acoustic Screening	-	Negligible screening through foliage etc.
Propagated Noise	**41 dB(A)**	1m outside nursery windows

Table 7.1: Plant Noise Calculation - Nursery

7.03 As discussed in section 6 of this report, the applicable noise level design criterion for the proposed new plant has been set at 42 dB(A) outside the nearest noise sensitive windows.

7.04 The calculated plant noise level is 1 dB(A) less than the design criterion and therefore satisfies the planning requirements of the London Borough of Camden with no need for further mitigation.

7.05 Other noise sensitive properties within the surrounding area, as described within section 3, are at greater distances from the plant and therefore receive lower levels of plant noise. This is summarised in tables 7.2 and 7.3 below for the nearby commercial property and university halls of residence respectively, confirming that the requirements of the London Borough of Camden are met at all surrounding noise sensitive properties.

Element	Level	Comments
Cumulative Source Noise	81 dB(A)	Cumulative source @1m. 8 No AHUs and 5 No Condensers.
Distance Attenuation	- 42 dB	Hemispherical Spreading, 130m
Directivity	- 2 dB	Approximately 30 ° off-axis. Mid and high frequency beaming.
Acoustic Screening	-	Negligible screening through foliage etc.
Propagated Noise	**37 dB(A)**	1m outside commercial windows

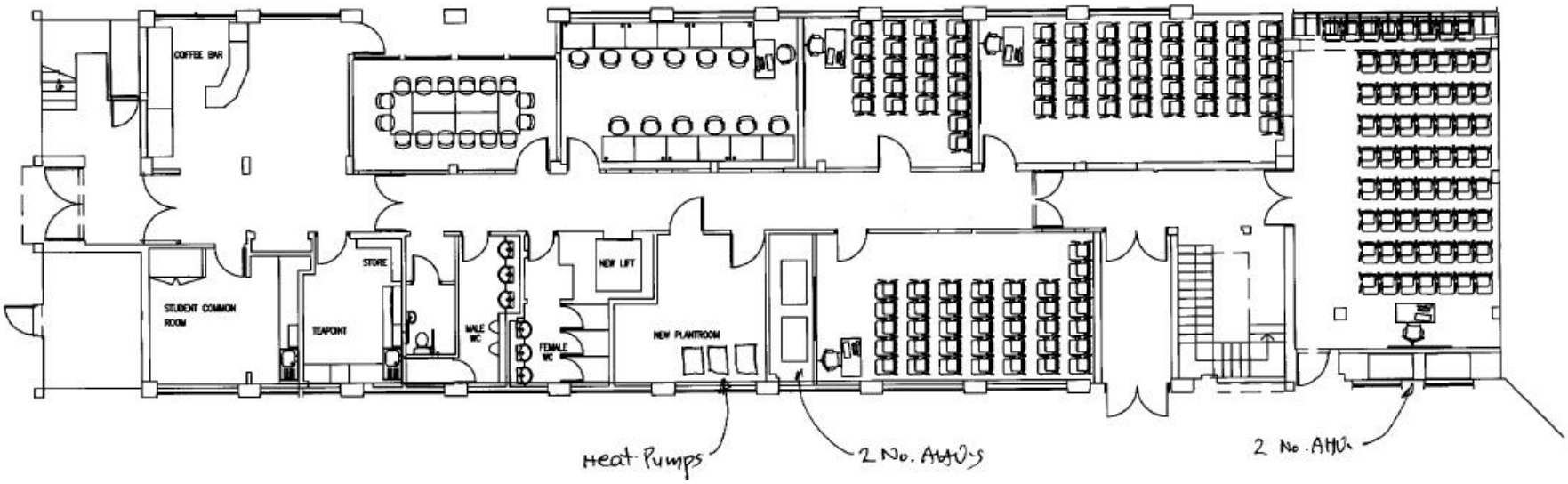
Table 7.1: Plant Noise Calculation – Commercial Property

Element	Level	Comments
Cumulative Source Noise	81 dB(A)	Cumulative source @1m. 8 No AHUs and 5 No Condensers.
Distance Attenuation	- 44 dB	Hemispherical Spreading, 170m
Directivity	- 2 dB	Approximately 30 ° off-axis. Mid and high frequency beaming.
Acoustic Screening	-	Negligible screening through foliage etc.
Propagated Noise	**35 dB(A)**	1m outside residential windows

Table 7.1: Plant Noise Calculation – University Halls of Residence

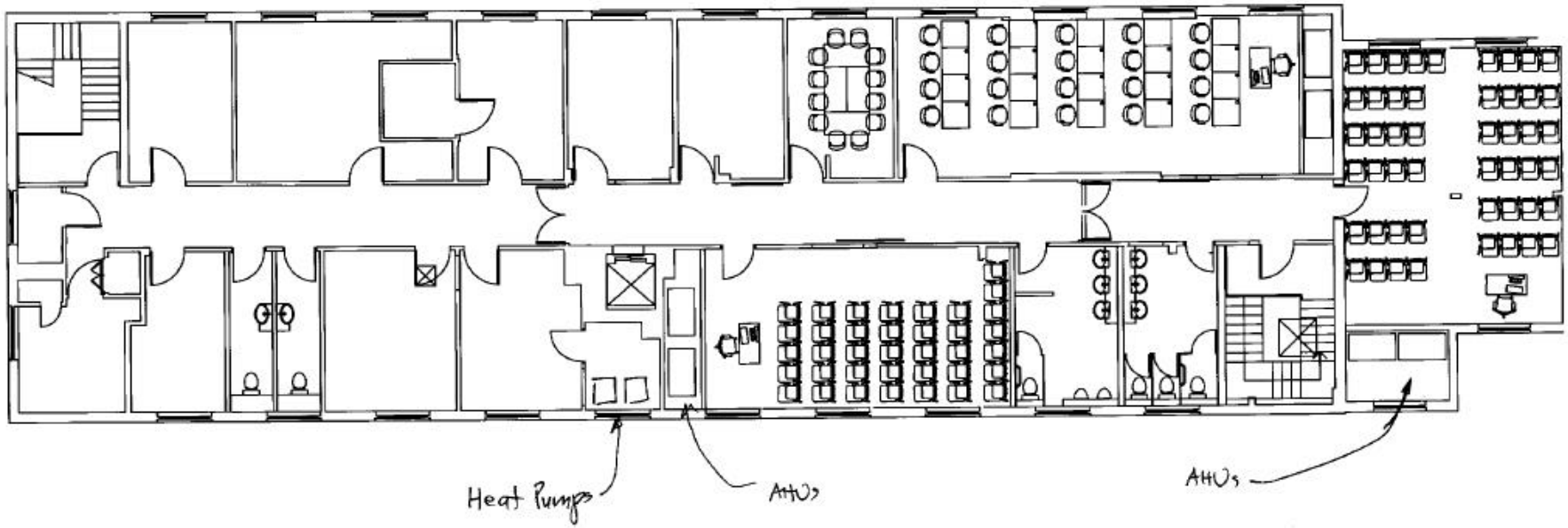
APPENDIX A

SITE PLAN
&
MEASUREMENT LOCATION



Ground Floor

First Floor



APPENDIX B

SURVEY RESULTS
(TABULAR)

EC 10661 - UCL Institute of Child Health

Fowler Martin

24 Hour Noise data

Time	$L_A$eq	L_A10	L_A90
15:50	66	65	52
15:55	55	56	53
16:00	55	56	53
16:05	55	56	53
16:10	58	59	54
16:15	58	61	54
16:20	58	61	54
16:25	57	59	54
16:30	58	61	54
16:35	60	61	54
16:40	58	61	54
16:45	57	59	54
16:50	56	58	53
16:55	59	60	54
17:00	64	60	53
17:05	61	59	53
17:10	60	59	53
17:15	58	59	53
17:20	60	61	54
17:25	67	65	54
17:30	60	59	53
17:35	57	60	53
17:40	59	61	53
17:45	61	62	54
17:50	58	60	53
17:55	61	60	53
18:00	61	60	53
18:05	57	59	52
18:10	65	68	53
18:15	62	63	54
18:20	60	63	54
18:25	68	66	53
18:30	66	64	53
18:35	67	67	54
18:40	67	67	54
18:45	66	65	54
18:50	68	69	55
18:55	66	66	54
19:00	67	67	54
19:05	61	61	53
19:10	55	56	52
19:15	56	58	52
19:20	59	58	52
19:25	57	58	51
19:30	65	61	53
19:35	65	62	53
19:40	60	61	52
19:45	59	60	52

Time	$L_A$eq	L_A10	L_A90
19:50	56	58	51
19:55	56	58	52
20:00	58	60	52
20:05	56	59	52
20:10	58	61	52
20:15	56	59	51
20:20	57	59	52
20:25	57	59	51
20:30	56	58	51
20:35	56	59	51
20:40	56	59	51
20:45	57	60	51
20:50	57	59	52
20:55	57	59	51
21:00	55	56	49
21:05	52	53	49
21:10	51	53	48
21:15	51	52	48
21:20	51	53	48
21:25	51	53	48
21:30	51	53	48
21:35	51	53	48
21:40	51	53	48
21:45	51	53	48
21:50	51	53	48
21:55	56	53	49
22:00	52	53	49
22:05	51	53	48
22:10	51	53	48
22:15	51	53	48
22:20	52	53	48
22:25	55	53	48
22:30	51	53	48
22:35	51	52	48
22:40	51	52	48
22:45	52	53	48
22:50	51	52	48
22:55	51	52	47
23:00	55	54	48
23:05	51	52	47
23:10	51	52	48
23:15	51	52	48
23:20	51	52	48
23:25	52	53	48
23:30	51	52	48
23:35	51	52	48
23:40	51	52	48
23:45	51	53	48

EC 10661 - UCL Institute of Child Health

Fowler Martin

24 Hour Noise data

Time	$L_A$eq	L_A10	L_A90
23:50	51	52	48
23:55	51	52	47
00:00	51	52	47
00:05	51	52	47
00:10	51	52	47
00:15	51	52	47
00:20	51	52	48
00:25	51	52	47
00:30	51	52	47
00:35	51	52	47
00:40	51	52	47
00:45	51	53	48
00:50	51	52	47
00:55	51	52	47
01:00	52	55	48
01:05	52	54	48
01:10	57	60	48
01:15	51	52	47
01:20	51	52	47
01:25	51	52	47
01:30	51	52	47
01:35	51	52	47
01:40	50	52	46
01:45	51	52	47
01:50	51	52	47
01:55	51	52	46
02:00	50	52	46
02:05	50	52	47
02:10	50	52	46
02:15	50	52	46
02:20	50	52	46
02:25	50	52	46
02:30	50	52	46
02:35	50	52	46
02:40	50	52	46
02:45	50	52	46
02:50	50	52	46
02:55	50	52	46
03:00	50	52	46
03:05	50	52	46
03:10	50	52	46
03:15	50	52	46
03:20	51	52	47
03:25	50	52	46
03:30	50	52	46
03:35	50	52	46
03:40	50	52	46
03:45	50	52	46

Time	$L_A$eq	L_A10	L_A90
03:50	51	52	46
03:55	50	52	46
04:00	50	52	46
04:05	50	52	46
04:10	50	52	46
04:15	51	52	47
04:20	51	52	47
04:25	50	52	46
04:30	51	52	47
04:35	50	52	46
04:40	51	52	47
04:45	51	52	47
04:50	51	52	47
04:55	50	52	47
05:00	51	52	47
05:05	51	52	47
05:10	51	52	47
05:15	51	52	47
05:20	54	54	47
05:25	52	53	48
05:30	51	53	48
05:35	51	52	48
05:40	51	53	48
05:45	51	52	47
05:50	51	52	47
05:55	51	52	47
06:00	54	55	48
06:05	51	53	48
06:10	51	53	48
06:15	52	54	49
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06:50	52	53	49
06:55	52	53	49
07:00	51	53	49
07:05	51	53	49
07:10	52	53	49
07:15	52	54	49
07:20	52	53	49
07:25	52	54	49
07:30	52	54	49
07:35	52	53	50
07:40	52	53	49
07:45	56	58	50

EC 10661 - UCL Institute of Child Health

Fowler Martin

24 Hour Noise data

Time	$L_A$eq	L_A10	L_A90
07:50	56	59	51
07:55	54	56	50
08:00	52	54	50
08:05	53	54	50
08:10	52	53	50
08:15	54	56	50
08:20	54	56	51
08:25	54	56	51
08:30	53	55	50
08:35	53	54	51
08:40	53	54	51
08:45	57	62	51
08:50	59	63	51
08:55	53	54	51
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09:05	53	54	51
09:10	53	54	51
09:15	53	54	51
09:20	53	54	51
09:25	53	54	51
09:30	57	62	51
09:35	53	54	51
09:40	53	54	51
09:45	53	54	51
09:50	53	55	51
09:55	56	57	51
10:00	54	55	51
10:05	62	68	53
10:10	56	59	52
10:15	60	55	51
10:20	67	58	52
10:25	55	54	51
10:30	57	54	51
10:35	53	54	51
10:40	53	54	51
10:45	53	54	51
10:50	54	55	51
10:55	54	55	52
11:00	54	55	52
11:05	53	55	51
11:10	54	55	51
11:15	56	58	53
11:20	54	56	52
11:25	54	55	52
11:30	53	55	51
11:35	53	54	51
11:40	53	54	52
11:45	54	55	52

Time	$L_A$eq	L_A10	L_A90
11:50	53	54	51
11:55	60	55	52
12:00	54	56	52
12:05	54	55	52
12:10	56	57	52
12:15	55	57	52
12:20	56	57	52
12:25	58	58	52
12:30	58	58	52
12:35	57	60	52
12:40	58	62	53
12:45	58	61	53
12:50	58	61	53
12:55	58	61	54
13:00	59	62	53
13:05	56	58	52
13:10	58	60	53
13:15	62	64	53
13:20	60	64	53
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13:35	61	63	55
13:40	61	63	55
13:45	62	65	55
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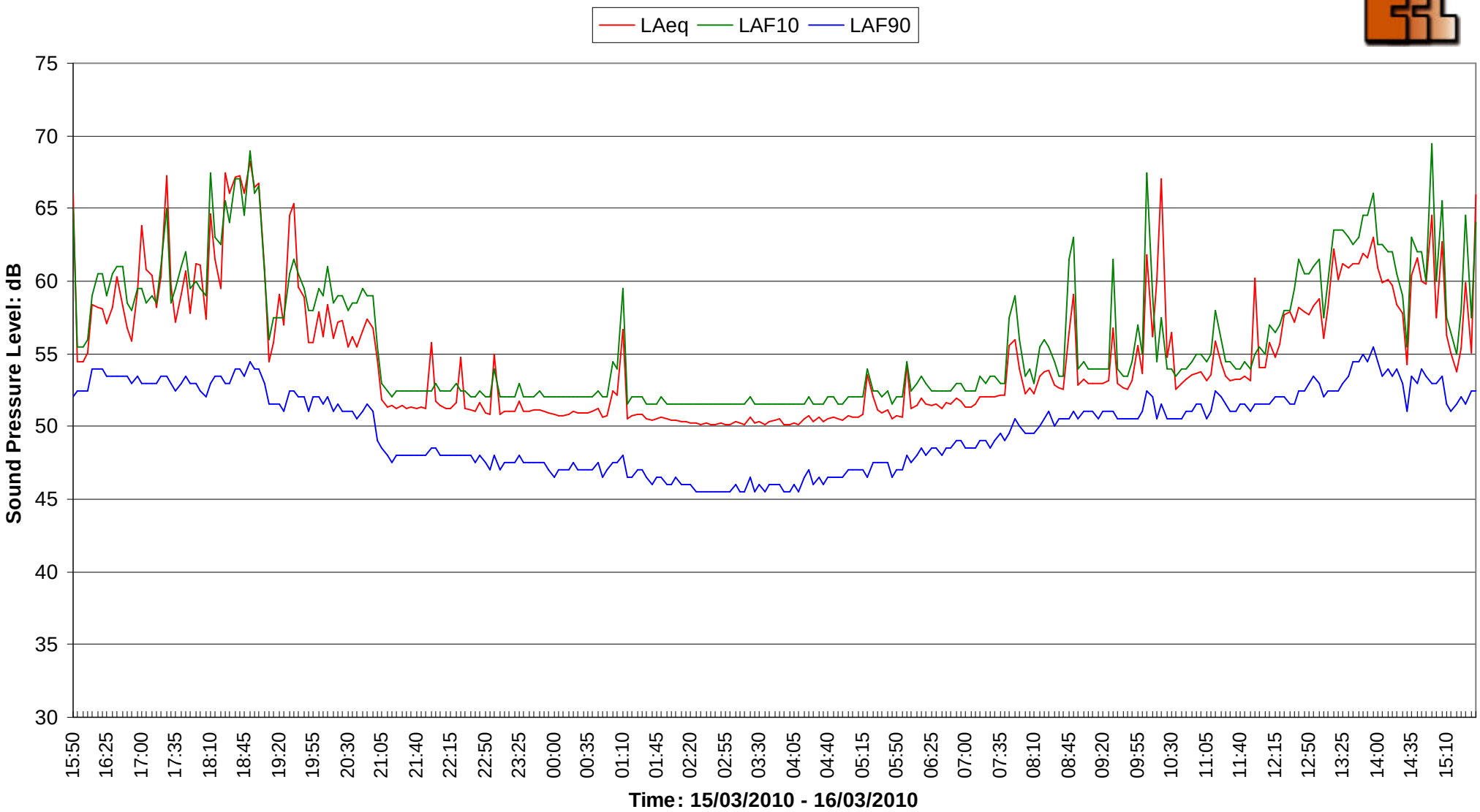
14:40	62	62	53
14:45	60	62	54
14:50	60	60	54
14:55	65	70	53
15:00	58	60	53
15:05	63	66	54
15:10	56	58	52
15:15	55	57	51
15:20	54	55	52
15:25	55	58	52
15:30	60	65	52
15:35	55	58	53
15:40	66	64	53

APPENDIX C

SURVEY RESULTS (GRAPHICAL)

Noise Level Time History @ UCL Institute of Child Health



APPENDIX D

GLOSSARY OF TECHNICAL TERMS

TECHNICAL TERMS AND UNITS

Decibel (dB) - This is the unit used to measure sound. The human ear has an approximately logarithmic response to sound over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). We therefore use a logarithmic scale to describe sound pressure levels, intensities and power levels. The logarithms used are to base 10; hence, an increase of 10 dB in sound pressure level corresponds to a doubling in perceived loudness of the sound.

Sound Power Level (PWL) - This is a function of the noise source alone and is independent of its surroundings. It is a measure of the amount of sound power output measured in decibels.

Sound Pressure Level (SPL) - This is a function of the source and its surroundings and is a measure of the sound pressure at a point in space. For example, a sound pressure level measured at 1 metre from a sound source of certain sound power in reverberant room will not be the same as the sound pressure level a 1 metre from the sound source measured in open space.

Octave and One-Third Octave Bands - The human ear is sensitive to sound over a range of approximately 20 Hz to 20 KHz and is generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum is divided into frequency bands and the sound pressure level is measured in each band. 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 finer analysis, each octave band may be split into three one-third octave bands.

"A" Weighting - A number of frequency weightings have been developed to imitate the ear's varying sensitivity to sound of different frequencies. The most commonly used weighting is the "A" weighting. The "A" weighted SPL can be measured directly or derived from octave or one-third octave band SPLs. The result is a single figure index which gives some idea of the subjective loudness of the sound, but which contains no information as to its frequency content.

Noise Rating (NR) Curves - The "A" weighted sound pressure level cannot be used to define a spectrum or to compare sounds of different frequencies. NR curves convey frequency information in a single-figure index. This is done by defining the maximum permissible sound pressure level at each frequency for each curve. To measure the noise rating of a given environment, the SPL is measured in octave or one-third octave bands and the noise rating is then the highest NR curve touched by the measured levels.

Typical NR levels for various environments are shown below:

Workshops	NR 60-70
Mechanised Office	NR 50-55
Gymnasium, Sport Halls, Swimming Baths	NR 40-50
Restaurants, Bars, Cafeterias	NR 35-45
Cinemas, Hospitals, Churches, Small Conference Rooms	NR 25-35
Concert Halls, Theatres	NR 20-25
Diagnostic Clinics, Audiometric Rooms	NR 10-20
Broadcasting Studios	NR 5-15

Intermittency and Time-Weighting - The degree of annoyance caused by a noise also depends on its duration and intermittency of a noise. Intermittent, impulsive or repetitive noises tend to be more annoying than continuous noises. Various time-weightings have been derived to measure sounds of differing intermittences and these can be measured directly on modern equipment. The most common time-weightings in use are as follows:-

L_{90} This is the sound pressure level exceeded for 90% of the measurement period. It is widely used to measure background noise levels.

L_{10} This is the sound pressure level exceeded for 10% of the measurement period. It is widely used to measure traffic noise. For a given measurement period, the L_{10} level is by definition greater than or equal to the L_{90} level.

L_{eq} The equivalent continuous noise level is often used to measure intermittent noise. It is defined as the notional steady noise level that would contain the same acoustic energy as the varying noise. Because the averaging process used is logarithmic, the L_{eq} level tends to be dominated by the higher noise levels measured.