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Project : *UCL - Rockefeller Medical Library*
Queens Square

BACKGROUND NOISE SURVEY AND PLANT ASSESSMENT

Client: *Fowler Martin Ltd*
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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 Rockefeller Medical Library, with a view to ascertaining prevailing background noise levels for the immediate vicinity.

1.02 Proposals are being submitted to the Camden Borough Council to install plant on the rooftop. 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 Rockefller Medical Library is located on Queen Square. Queen Square comprises predominantly University property with some residential and commercial properties. Appendix A shows a plan of the proposed roof layout and notes indicating properties in the surrounding area.

2.02 The nearest affected noise sensitive property is the President Hotel which lies 20m to the West, opposite the proposed plant area with a direct line of site to the plant area. We understand that the top two floors of the hotel are a penthouse apartment. There is a closer window located at Flat P, Guilford Court approximately 10m north of the plant location, however, due to the natural acoustic screening provided by the existing building it is less noise sensitive than the President Hotel opposite, as shown in the assessment below.

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 1130hrs, Monday 26 October and 1130hrs, Tuesday 27 October 2009. However, the period of interest is between 2300 hrs and 0700 hrs which covers the worst case proposed operating times.

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

3.04 Weather conditions during the survey were generally calm and clear.

4.00 EQUIPMENT

4.01 Equipment for the survey was as follows:-

- Brüel & Kjær type 2260 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 accreditation and serial numbers as follows:

Sound Level Meter B&K2260	Serial No.	2248275
	Calibration Date	13 October 2009
	Cal Certificate No.	C0908531
½" Condenser Mic. B&K4189	Serial No.	2502922
	Calibration Date	13 October 2009
	Cal Certificate No.	C0908531
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 average 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)	62.2	50.5
Evening (1900-2300 hrs)	55.4	48.0
Night-time (2300-0700 hrs)	52.5	44.1

Table 5.1: Measured Ambient and Background Noise Levels

6.00 DISCUSSION

6.01 Camden Borough Council 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 It is assumed that plant will operate 24 hours a day (0000 hrs – 0000 hrs), therefore, based on the measured noise levels, as summarised in Table 5.1 noise emitted from the proposed plant should not exceed 39 dB(A) at 1m external of the nearest noise sensitive window.

7.00 PLANT ASSESSMENT

7.01 The proposed plant consists of 1 No. REY-Q20P Daikin condenser with a manufacturer's published noise level of 62 dB(A) @ 1m and 1 No. 322T1A11N3BN Denco condenser with a manufacturer's published noise level of 60 dB(A) @ 3m. There are currently two proposed screening options. Both proposals include for a 2m high acoustic louvred screen surrounding the plant to provide both a visual and acoustic barrier to the President Hotel and penthouse apartment. Option 1 comprises solely a high performance acoustic louvre screen. Option 2 comprises a shallower acoustic louvre screen and in addition to the screen the wall behind the units will be acoustically lined. Both these options provide the same level of acoustic and visual screening. Figure 1 below shows an example of an acoustic louvre, as viewed from the front.

Figure 1: Front view of an example acoustic louvre screen.

Assessment to President Hotel

7.02 Allowing for distance attenuation over 20 m, the cumulative plant noise level outside the windows of the penthouse apartment above the President Hotel have been calculated to be 39 dB(A), as indicated below.

Element	Level	Comments
Cumulative Source Noise	69 dB(A)	Due to 2No units @ 1m
Distance Attenuation	- 25 dB	20m – Parallelepiped method
Reflective Surfaces	+3 dB	
Acoustic Screening	-8 dB	Loss due to acoustic screen
Propagated Noise	**39 dB(A)**	1m outside residential windows

Table 7.1: Plant Noise Calculation To President Hotel

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 39 dB(A) outside the nearest noise sensitive windows.

7.04 The calculated plant noise levels meet the design criterion and therefore should satisfy the planning requirements of Camden Borough Council.

Assessment to Flat P, Guilford Court

7.05 Allowing for distance attenuation over 10 m, the cumulative plant noise level outside the windows of the Flat P, Guilford Court have been calculated to be 38 dB(A), as indicated below.

Element	Level	Comments
Cumulative Source Noise	69 dB(A)	Due to 2No units @ 1m
Distance Attenuation	- 21 dB	10m – Parallelepiped method
Reflective Surfaces	+3 dB	
Acoustic Screening	-13 dB	Loss due to natural building screening
Propagated Noise	**38 dB(A)**	1m outside residential windows

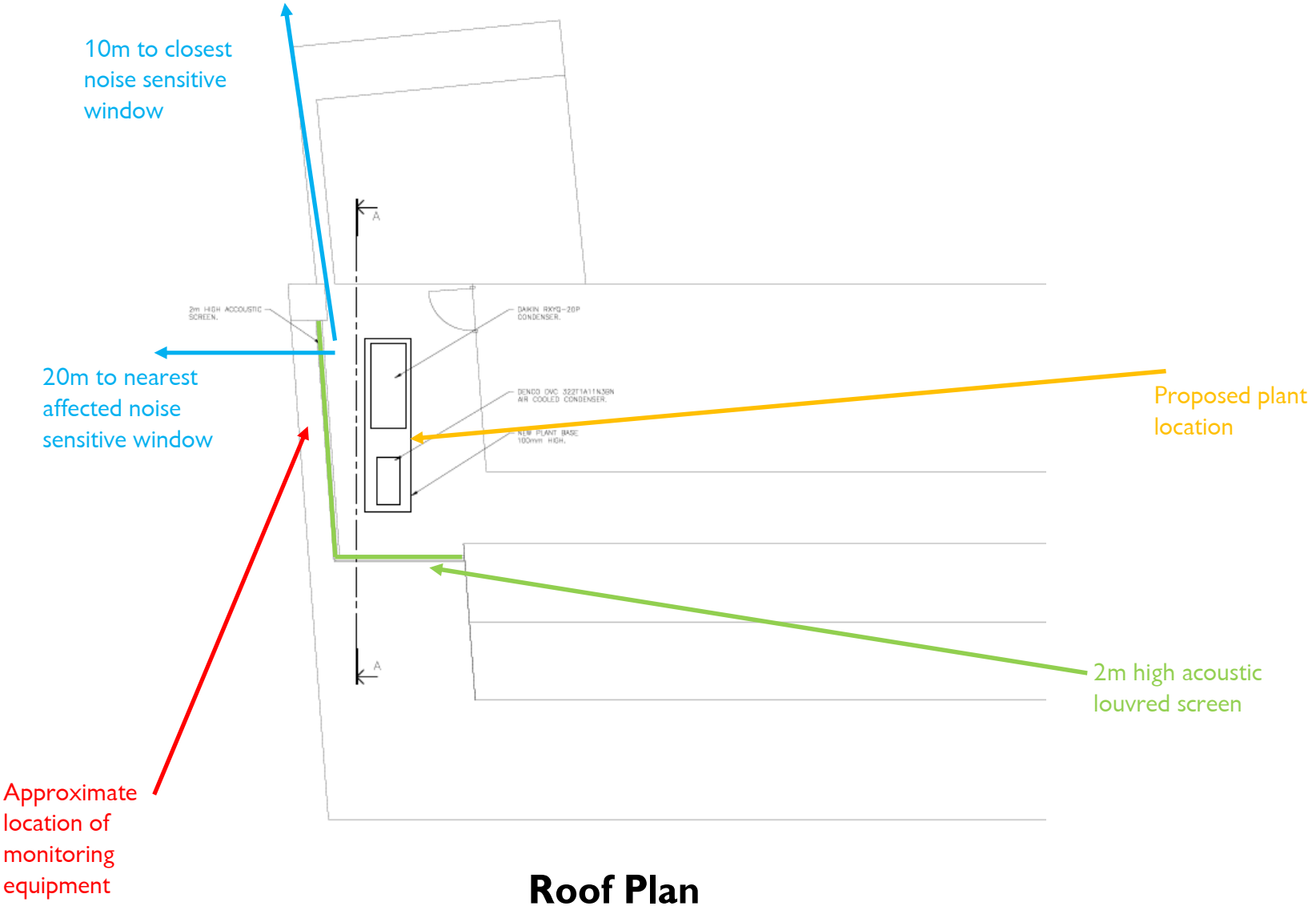
Table 7.2: Plant Noise Calculation to Flat P, Guilford Court

7.06 As discussed in Section 6 of this report, the applicable noise level design criterion for the proposed new plant has been set at 39 dB(A) outside the nearest noise sensitive windows.

7.07 The calculated plant noise levels are 1 dB below the design criterion and therefore should satisfy the planning requirements of Camden Borough Council.

APPENDIX A

SITE PLAN
&
MEASUREMENT LOCATION


10m to closest noise sensitive window
20m to nearest affected noise sensitive window
Proposed plant location
2m high acoustic louvred screen
Approximate location of monitoring equipment
2m HIGH ACCOUSTIC SCREEN.
DAIKIN RXYQ-20P CONDENSER.
DENCO DVC 322T1A11N3BN AIR COOLED CONDENSER.
NEW PLANT BASE 100mm HIGH.
A
A

Roof Plan

APPENDIX B

SURVEY RESULTS
(TABULAR)

EC 10408 - Rockefeller Medical Library

Fowler Martin

24 Hour Noise data

Time	L_Aeq	L_A10	L_A90
11:30	63	61	53
11:35	57	59	53
11:40	58	60	54
11:45	58	61	54
11:50	58	61	53
11:55	57	60	53
12:00	59	61	54
12:05	57	59	53
12:10	62	66	56
12:15	64	64	55
12:20	61	65	53
12:25	57	60	52
12:30	57	60	53
12:35	57	59	53
12:40	58	61	52
12:45	56	58	53
12:50	59	60	53
12:55	57	59	52
13:00	58	60	54
13:05	60	61	55
13:10	61	64	55
13:15	61	63	56
13:20	58	60	54
13:25	62	65	56
13:30	63	65	59
13:35	63	66	57
13:40	65	69	59
13:45	67	70	60
13:50	66	70	57
13:55	58	60	54
14:00	59	62	56
14:05	60	62	56
14:10	61	64	54
14:15	61	62	57
14:20	60	62	55
14:25	62	63	57
14:30	58	60	55
14:35	57	60	53
14:40	57	59	52
14:45	57	59	52
14:50	61	62	52
14:55	59	61	54
15:00	59	62	54
15:05	61	64	54
15:10	63	65	59
15:15	73	76	59
15:20	60	62	57
15:25	62	64	59

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

EC 10408 - Rockefeller Medical Library

Fowler Martin

24 Hour Noise data

Time	L_Aeq	L_A10	L_A90
19:30	54	57	50
19:35	53	57	49
19:40	54	58	50
19:45	55	58	50
19:50	55	58	50
19:55	54	57	50
20:00	55	59	49
20:05	53	57	49
20:10	55	58	50
20:15	54	57	50
20:20	53	56	49
20:25	54	57	50
20:30	55	59	49
20:35	55	57	49
20:40	53	56	49
20:45	55	58	49
20:50	55	58	48
20:55	53	57	49
21:00	53	56	49
21:05	53	56	49
21:10	52	55	49
21:15	52	56	48
21:20	52	55	49
21:25	67	62	49
21:30	53	56	50
21:35	53	55	49
21:40	54	57	49
21:45	53	56	50
21:50	52	55	49
21:55	53	56	49
22:00	54	57	49
22:05	54	57	50
22:10	53	56	49
22:15	55	58	51
22:20	53	57	49
22:25	55	59	49
22:30	55	58	49
22:35	54	57	49
22:40	53	57	48
22:45	53	55	49
22:50	52	55	48
22:55	53	56	48
23:00	52	56	48
23:05	51	55	48
23:10	52	54	48
23:15	54	56	48
23:20	51	55	48
23:25	53	57	48

Time	L_Aeq	L_A10	L_A90
23:30	52	55	48
23:35	52	56	47
23:40	52	55	47
23:45	50	52	47
23:50	51	52	48
23:55	51	53	47
00:00	52	56	47
00:05	50	51	48
00:10	55	58	49
00:15	56	60	50
00:20	52	56	47
00:25	50	51	47
00:30	51	54	47
00:35	49	50	47
00:40	51	50	47
00:45	51	53	47
00:50	49	51	46
00:55	50	51	47
01:00	50	52	47
01:05	48	49	46
01:10	49	51	47
01:15	49	50	47
01:20	50	52	47
01:25	50	52	47
01:30	49	52	47
01:35	49	50	47
01:40	49	49	46
01:45	49	51	47
01:50	49	50	47
01:55	49	51	47
02:00	50	51	47
02:05	49	50	47
02:10	50	53	47
02:15	54	56	47
02:20	48	48	47
02:25	50	52	47
02:30	50	52	45
02:35	49	49	44
02:40	49	51	45
02:45	49	51	45
02:50	49	51	44
02:55	50	50	45
03:00	50	50	44
03:05	49	51	45
03:10	50	52	45
03:15	47	46	44
03:20	52	54	45
03:25	53	57	45

EC 10408 - Rockefeller Medical Library

Fowler Martin

24 Hour Noise data

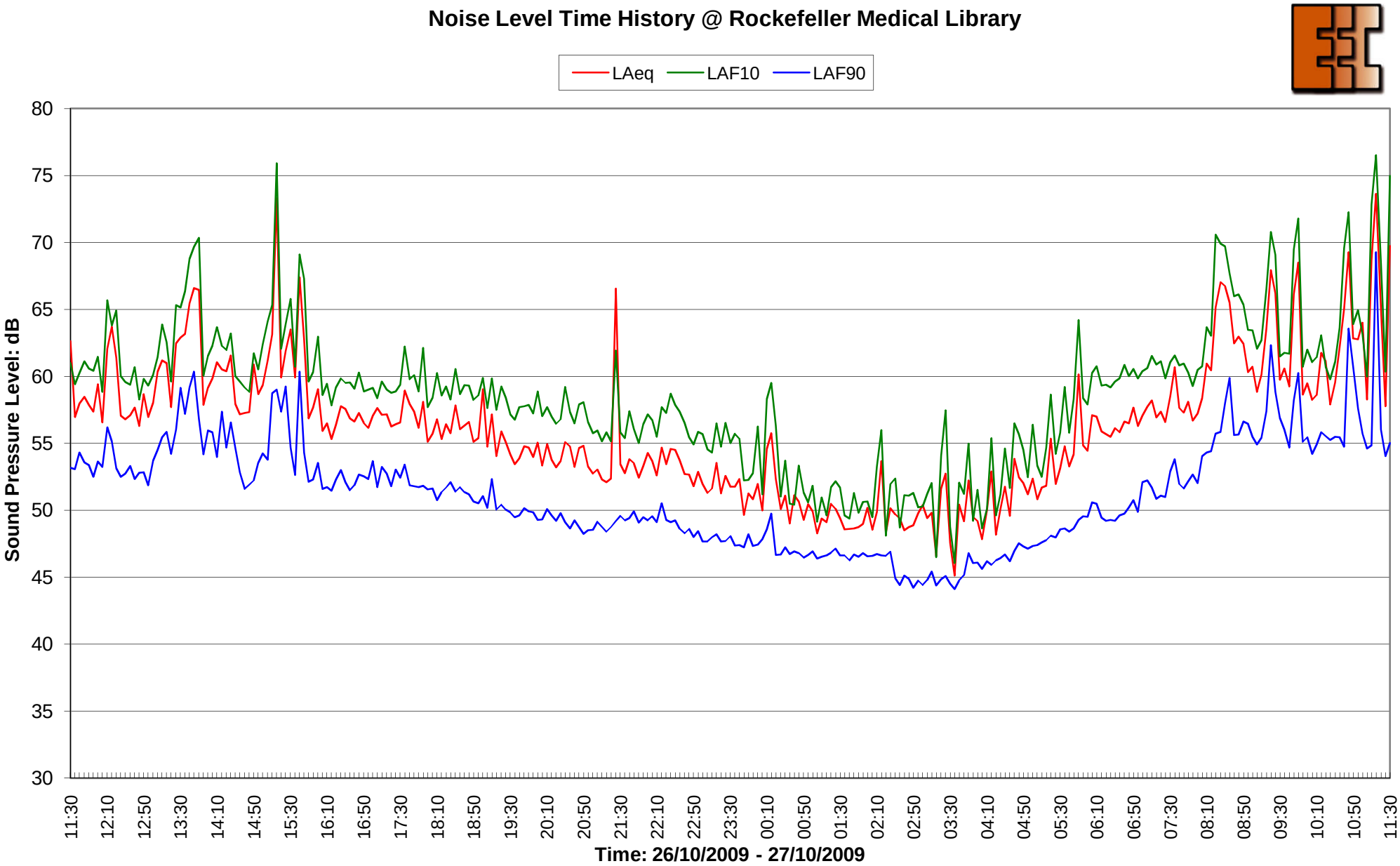
Time	L_Aeq	L_A10	L_A90
03:30	48	49	45
03:35	45	46	44
03:40	50	52	45
03:45	49	51	45
03:50	52	55	47
03:55	49	49	46
04:00	49	52	46
04:05	48	49	46
04:10	50	50	46
04:15	53	55	46
04:20	48	50	46
04:25	50	51	46
04:30	52	55	47
04:35	50	52	46
04:40	54	57	47
04:45	52	56	48
04:50	52	55	47
04:55	51	52	47
05:00	52	56	47
05:05	51	53	47
05:10	52	52	48
05:15	52	55	48
05:20	55	59	48
05:25	52	54	48
05:30	53	56	49
05:35	55	59	49
05:40	53	56	48
05:45	54	58	49
05:50	60	64	49
05:55	55	58	50
06:00	54	58	50
06:05	57	60	51
06:10	57	61	50
06:15	56	59	49
06:20	56	59	49
06:25	55	59	49
06:30	56	60	49
06:35	56	60	50
06:40	57	61	50
06:45	56	60	50
06:50	58	61	51
06:55	56	60	50
07:00	57	60	52
07:05	58	61	52
07:10	58	62	52
07:15	57	61	51
07:20	57	61	51
07:25	57	60	51

Time	L_Aeq	L_A10	L_A90
07:30	58	61	53
07:35	61	62	54
07:40	58	61	52
07:45	57	61	52
07:50	58	60	52
07:55	57	59	53
08:00	57	61	52
08:05	58	61	54
08:10	61	64	54
08:15	60	63	54
08:20	65	71	56
08:25	67	70	56
08:30	67	70	58
08:35	66	68	60
08:40	62	66	56
08:45	63	66	56
08:50	62	65	57
08:55	60	63	56
09:00	61	63	55
09:05	59	62	55
09:10	60	63	55
09:15	64	67	57
09:20	68	71	62
09:25	66	69	59
09:30	60	61	57
09:35	61	62	56
09:40	59	62	55
09:45	66	69	58
09:50	68	72	60
09:55	59	61	55
10:00	59	62	55
10:05	58	61	54
10:10	59	61	55
10:15	62	63	56
10:20	61	61	56
10:25	58	60	55
10:30	60	61	55
10:35	62	64	55
10:40	65	70	55
10:45	69	72	64
10:50	63	64	61
10:55	63	65	58
11:00	64	63	56
11:05	58	60	55
11:10	69	73	55
11:15	74	77	69
11:20	65	68	56
11:25	58	60	54

APPENDIX C

SURVEY RESULTS (GRAPHICAL)

Noise Level Time History @ Rockefeller Medical Library



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.