MR ERIC DEBRAY

AIR CONDITIONING UNIT AT 54 ABERDARE GARDENS

NOISE ASSESSMENT

FIRST DRAFT

AUGUST 2010

ADDISCOMBE ENVIRONMENTAL CONSULTANTS LIMITED

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AECL\1328\01	August 2010	Signature
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1. INTRODUCTION

1.1 Introduction

1.1.1 Mr Eric Debray has installed an air conditioning unit on the roof of the ground floor flat at 54 Aberdare Gardens, London NW6 3QD. The site is currently in use as residential flats and the air condenser unit services Flat 1 of 54 Aberdare Gardens located on the ground floor of the building.

1.1.2 The unit is proposed to operate only between the hours of 08:00 – 21:00 outside of these hours it is understood the unit will remain switched off

1.1.3 London Borough of Camden, the local authority, has requested that an assessment of noise from the units is undertaken in order to ensure noise levels will be acceptable at the nearest noise sensitive residential receiver.

1.1.4 Mr Eric Debray has therefore commissioned Addiscombe Environmental Consultants Limited (AECL) to undertake an assessment of noise generated by the units and this report presents the results of the assessment.

2. NOISE UNITS AND GUIDANCE

2.1 Noise Units

2.1.1 Noise is defined as unwanted sound. The range of audible sound is from 0 dB to 140 dB. The frequency response of the ear is usually taken to be about 18 Hz (number of oscillations per second) to 18000 Hz. The ear does not respond equally to different frequencies at the same level. It is more sensitive in the mid-frequency range than the lower and higher frequencies and because of this, the low and high frequency components of a sound are reduced in importance by applying a weighting (filtering) circuit to the noise measuring instrument. The weighting which is most widely used and which correlates best with subjective response to noise is the dB(A) weighting. This is an internationally accepted standard for noise measurements.

2.1.2 For variable noise sources such as traffic, a difference of 3 dB is just distinguishable. In addition, a doubling of traffic flow will increase the overall noise by 3 dB. The "loudness" of a noise is a purely subjective parameter, but it is generally accepted that an increase/decrease of 10 dB corresponds to a doubling/halving in perceived loudness.

2.1.3 External noise levels are rarely steady, but rise and fall according to activities within an area. In an attempt to produce a figure that relates this variable noise level to subjective response, a number of noise indices have been developed. These include:

i) The L_{Amax} noise level;

This is the maximum noise level recorded over the measurement period and provides an indication of the highest noise levels registered during the measurement period.

ii) The $L_{Aeq,T}$ noise level;

This is the "equivalent continuous A-weighted sound pressure level, in decibels" and is defined in British Standard (BS) 7445 [1] as the "value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval, T, has the same mean square sound pressure as a sound under consideration whose level varies with time".

It is a unit commonly used to describe construction noise, noise from industrial premises and is the most suitable unit for the description of other forms of environmental noise.

iii) The L_{A10} noise level;

This is the noise level that is exceeded for 10% of the measurement period and gives an indication of the noisier levels. It is a unit that has been used over many years for the measurement and assessment of road traffic noise

2.2 Method of Assessing Noise From Fixed Installations

2.2.1 BS 4142 [2] provides a method for rating industrial noise affecting mixed residential and industrial areas. It was first published in 1967 and has been extensively used by local authorities and consultants to rate noise from fixed installations, such as plant noise. The standard was considerably revised in 1990 and clarified in 1997 and advocates the use of $L_{Aeq,T}$, a level, which is directly measurable and termed the Specific Noise Level when corrected for the duration of the noise. The Specific Noise Level is then corrected for character, if appropriate (see paragraph 2.2.2) and termed the Rating Level. When used to assess industrial noise, the Rating Level is determined and the L_{A90} background level is subtracted from it. A difference of around 10 dB or higher indicates that complaints are likely. A difference of around 5 dB is of marginal significance. A difference of –10 dB is a positive indication that complaints are unlikely.

2.2.2 BS 4142 requires a +5 dB correction to be applied to the Specific Noise Level if the noise contains a distinguishable, discrete, continuous note (whine, hiss, screech, hum etc), or if there are distinct impulses in the noise (bangs, clicks, clatters, or thumps), or if the noise is irregular enough in character to attract attention. The Specific Noise Level then becomes the Rating Level.

2.2.3 BS 4142:1997 states that the assessment location should normally be freefield, however, when making measurements above ground floor level it states: '*choose a position which is 1m from the façade on the relevant floor of the building'.* Measurements should be taken at a preferred height of between 1.2 and 1.5m above ground level.

2.3 Local Authority Noise Criteria

2.3.1 London Borough of Camden, the local authority, have advised the following limits in their Unitary Development Plan (Table E of Appendix 1) which apply when seeking planning permission for installation of any new plant or machinery:

Table 2.1 Table E Noise levels from plant and machinery at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Noise Level
Noise at 1 metre external to a sensitive facade	Day, Evening and Night	0000 - 2400	5dB(A) <LA90
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive facade	Day, Evening and Night	0000 - 2400	10dB(A) <LA90
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a noise sensitive façade	Day, Evening and Night	0000 - 2400	10dB(A) <LA90
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, Evening and Night	0000 - 2400	55dB LAeq

3. SITE DESCRIPTION AND PLANT DETAILS

3.1 Site Description

3.1.1 The site is located at 54 Aberdare Gardens London NW6 3QD and is currently in use as occupied residential flats. It is intended that the unit will operate as and when required between the hours of 08:00 to 21:00.

3.1.2 The site is located in a predominantly residential area with residential dwellings located on all floors of the property. The location of the air conditioning units is on flat roof above the ground floor flat on the south facing façade of the building. Although there is no direct line of sight to the front of the unit from any of the nearby residential windows, the unit is located approximately 1 metre below a bedroom window on the first floor. The nearest window with a line of site lies approximately 80 metres to the south and is screened by a line of trees

3.1.3 The site is bounded by Aberdare Gardens to the north, residential buildings on Aberdare Gardens to the east and west and an open garden to the south. Further from the site, the area is built up with residential properties on all sides. The nearby roads are all speed restricted to 20mph and traffic was noted as being infrequent.

3.1.4 A site layout drawing is provided in Figure 1.

3.1.5 This noise assessment has been carried out at 1 metre from the nearest window of the noise sensitive premises as per the instruction given by London Borough of Camden, the Local Authority.

3.1.6 The noise climate at the site, during the survey period, was subjectively noticed to be primarily influenced by bird song, infrequent local road traffic noise from Aberdare Gardens, and from residents of nearby houses conversing with the windows open.

3.2 Plant Details

3.2.1 The plant comprises one air conditioning unit; a Daikin RXS60F2V1B unit currently operating on demand, as and when required, between the hours of 08:00 and 21:00

4. NOISE MONITORING

4.1 General

4.1.1 London Borough of Camden the Local Authority, has indicated that: the level of noise from any new plant at 1 metre from the nearest noise sensitive facade shall be lower than the existing background level by at least 5dB, except where the noise contains tonal components, or any impulsive characteristics, in which case the level of noise at the nearest noise sensitive façade must not exceed a level of 10dB below the existing background. This is interpreted as requiring the $L_{Aeq,05mins}$ from the units to be at least 5 dB below the lowest measured $L_{A90,05mins}$ in the absence of noise from the units (or 10 dB where tonal or impulsive components are present).

4.1.2 An unattended noise survey was carried out on Monday 02nd August 2010 between 07:52 and 20:52 hours at 1m from the window of the nearest noise-sensitive façade (the bedroom of the first floor flat). The monitoring location is shown in Figure 1.

4.1.3 Source term measurements were carried on Monday 02nd August 2010 between 21:10 and 21:25 at 10cm from the unit while it was operating.

4.2 Instrumentation

4.2.1 The following instrumentation was used for the background noise survey:

- Rion type NL-32 Sound Level Meter (S/N00640762)
- Rion type NH-21 Pre-amplifier (S/N306634)
- Rion Type UC-53A Microphone (S/N11822)
- Rion NC-74 Acoustic Calibrator (S/N 00110080)

4.2.2 The following instrumentation was used for the source term measurements:

- Rion type NA-27 Sound Level Meter (S/N00121720)
- Rion type NH-20 Pre-amplifier (S/N46012)
- Rion Type UC-53A Microphone (S/N308435)
- Rion NC-74 Acoustic Calibrator (S/N 00110080)

4.2.3 All equipment is within current manufacturer's periods of calibration and calibration certificates are attached in Appendix A.

4.2.4 Before and after the survey period, the calibration of the instrumentation was checked using the acoustic calibrator. Calibration levels are reported in Appendix B and no significant drift was noted.

4.3 Instrumentation Set-Up

Background Noise Measurements at 1m from the nearest noise sensitive façade

4.3.1 The instrument was set to record the following noise metrics over 05 minute periods:

- L_{Aeq}

- L_{Amax}
- L_{A10}
- L_{A90}

4.3.2 The frequency response of the meter was set to "A" and the time weighting was set to "Fast".

Source Term Noise Measurements of Condenser Units

4.3.3 The frequency response of the meter was set to "Flat" and the time weighting was set to "Fast". The L_{eq} metric was measured in 1/3-octave bands and the overall A-weighted level was measured simultaneously. A measurement duration of 10 seconds was used.

4.4 Meteorological Conditions

4.4.1 The meteorological conditions were dry with 50% cloud cover and wind speeds of less than $1m/s^{-1}$.

4.5 Measurement Results

4.5.1 Full noise monitoring results are presented in tabular form in Appendix B.

4.5.2 Background noise levels measured at the window of the nearest noise sensitive façade are presented in Table B1 of Appendix B. The lowest measured background noise level was at 09:52 when a level of 37.0 dB $L_{A90,5mins}$ was measured.

4.5.3 Measured noise levels at 0.1m from the operating unit are presented in Table B2 of Appendix B. The sound power level of the unit has been determined from these measurements and is 57.7 dB(A).

4.5.4 A summary of the measurement results is provided in Table 4.1.

Table 4.1: Noise Measurement Summary

Parameter	dB(A)
Background Noise Level at 1m from nearest residential window ($L_{A90\ 5\ mins}$)	37.0
Specific Level of the unit operating at the nearest noise sensitive façade ($L_{Aeq\ 5\ mins}$)	42.2

5. NOISE ASSESSMENT

5.1 Noise Assessment

5.1.1 The results of the noise measurements have been used to undertake the assessment.

5.1.2 The noise calculation and BS 4142 assessment is summarised in Table 5.1, below. The Specific noise level is presented, along with the lowest measured background level and the difference between these levels. Noise from the unit is not considered to contain tonal or impulsive components.

Table 5.1: Noise Calculations and BS 4142 Assessment

Parameter	Calculations
Measured Level of unit operating *	42.2 dB(A)
Correction for tonal or impulsive characteristics	0 dB
Rating Level	42.2 dB(A)
Lowest measured background noise level ($L_{A90\ 5\ mins}$)	37.0 dB(A)
Difference between rating level and background noise level	5.3 dB

*3 measurements were taken and these are recorded in Table B3 in the Appendix, however two of these measurements were noted to be subject to adverse interference from aircraft and social interaction

5.1.3 Table 5.1 indicates that the Rating Level is 5.3 dB above the lowest measured background noise level of 37.0 dB $L_{A90,5\ Mins}$. This corresponds to an indication that complaints will be "of marginal significance" under BS4142.

5.1.4 Under the London Borough of Camden Unitary Plan planning permission would not be granted, as the unit is not les than 5dB below the LA90.

5.1.5 It is suggested that the unit be relocated at ground floor level on the rear façade adjacent to the rear bay window and the rear doorway. In this position there will be no direct line of sight to any of the residential windows of the upper floors or adjacent properties.

5.1.6 A preliminary noise assessment has been carried out as follows assuming a height of 4m for the ground floor flat and a distance of 4m from the edge of the roof of the ground floor flat to the rear wall of the property where the nearest noise sensitive window is situated

Table 5.3 Predicted Noise Levels of relocated unit

Parameter	**Calculations**
Sound power level of condenser unit (Daikin RXS60F2V1B)	57.7 dB(A)
Revised distance from noise source to receiver (first floor flat)	5.5 metres
Distance correction (based on simple spherical spreading)	-25.8 dB
Screening correction (no line of sight)	- 10 dB
Façade correction	+3 dB

Specific noise level at receiver	24.9 dB(A)
Penalty for tonal or impulsive noise	0 dB
Rating level (Specific noise level + BS 4142 correction)	24.9 dB
Lowest measured background noise level ($L_{A90\ 5\ mins}$)	37.0 dB(A)
Difference between rating level and background noise level	-12.1 dB

5.1.7 An assessment under BS4142 demonstrates that there is a positive indication that complaints would be unlikely if operated between the current proposed hours (08:00 and 21:00 hours).

5.1.8 In addition, noise from the unit complies with the London Borough of Camden's requirements to be at least 5 dB below the background level.

6. CONCLUSIONS

6.1 A noise survey has been undertaken in order assess noise levels generated by an air conditioning unit installed at 54 Aberdare Gardens and the results have been compared against the criteria supplied by the local authority, London Borough of Camden.

6.2 The noise survey has been indicated that the lowest existing background noise level was 37.0 dB $L_{A90,\ 5\ Mins}$ at the nearest noise sensitive façade, over the proposed hours of operation of the unit (08:00 to 21:00 hours).

6.3 With the unit its current position, the Rating Level is 43.3 dB(A) and this is 6.3 dB above the lowest measured background noise level. This corresponds to an indication that complaints will be "of marginal significance" under BS4142. In addition, this does not meet the local authority requirements as it is not less than 5dB(A) below the lowest measured background level.

6.4 It is suggested the unit be relocated to a position on the rear façade. Noise calculations have indicated that at this location, the Rating Level will be 12.1 dB below the lowest background level. This is a positive indication that complaints are unlikely under BS 4142 and also complies with the requirements of London Borough of Camden's Unitary Development Plan.

6.5 It is concluded, therefore, that if the unit is relocated to a position on the ground at the rear of the building, there are no reasons, on noise grounds, why planning permission for the unit should not be granted.

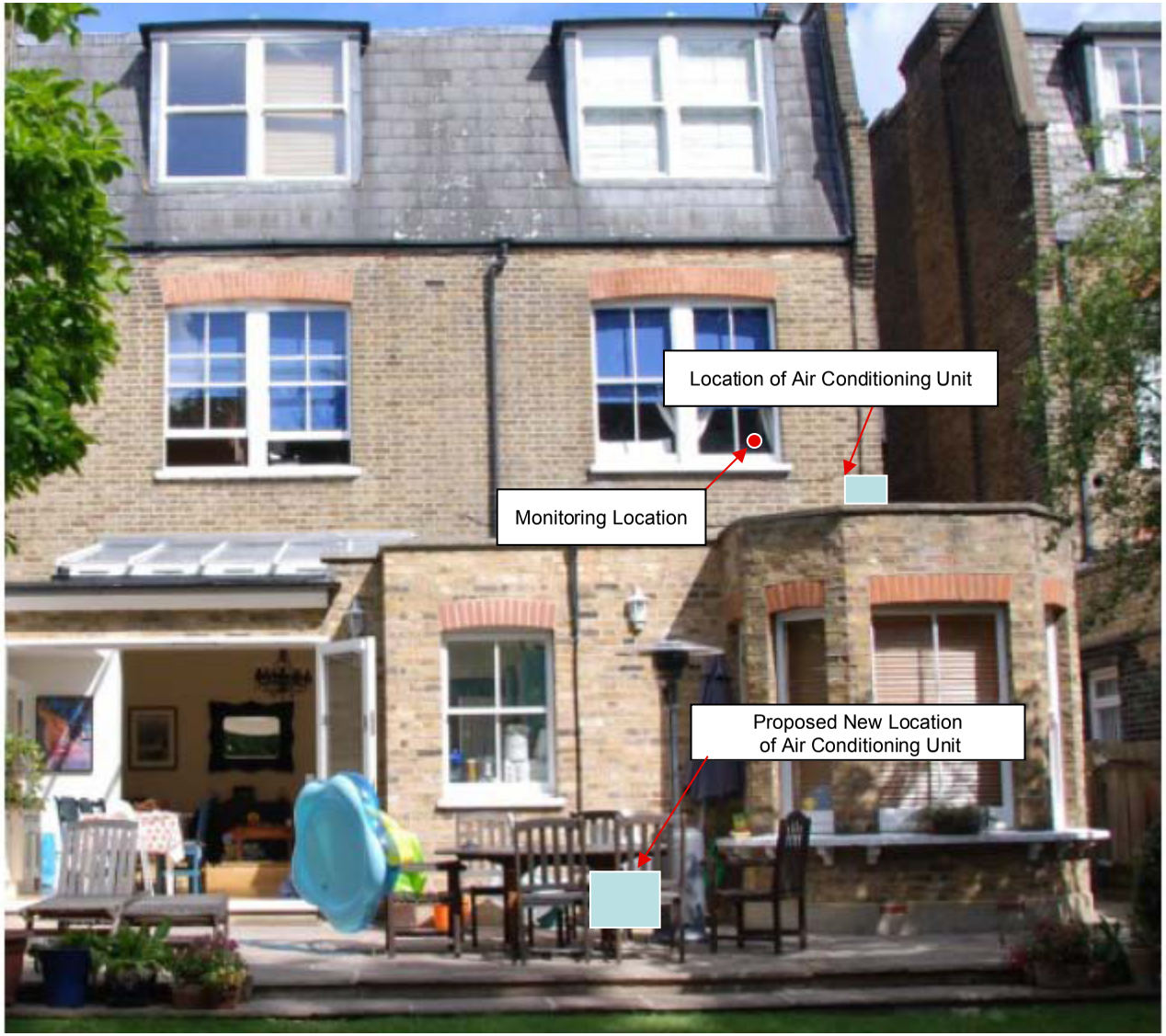
7. REFERENCES

1. British Standards Institution. British Standard 7445: Description and measurement of environmental noise. Guide to quantities and procedures.

2. British Standards Institution. British Standard (BS) 4142: Method for rating industrial noise affecting mixed residential and industrial areas, 1997

3. Camden Unitary Development Plan 2006

FIGURE



Project. 54 Aberdare Gardens	No. 1328	Drawing Noise Monitoring Location	No. Figure 1	File N:\projects\1328\Figure1.ppt	Date 02/08/2010

APPENDIX A

Calibration Certificates

Measurement Systems

CERTIFICATE OF CALIBRATION

Certificate Number	**CAL010905**
Date of Issue	**07/01/2009**
Customer	**Addiscombe Environmental Consultants Ltd**
	Description of Instrument
Sound Level Meter	Rion NL-32 Sound Level Analyser [Serial No. 00640762] with Rion UC-53A Microphone [Serial No.315082] and Rion NH-21 Preamplifier [Serial No.11822] Fitted with a WS-10 foam windshield. The instrument successfully completed the Class 1 Periodic Tests of BS EN 61672.
Associated Calibrator	B & K 4226 S/N 2590976.
Date of Calibration	07/01/2009.
Test Procedure	..\..\Calibration Procedures\Current Approved Procedures\NL 31_32 Cal Procedure Approved Issue 1.xls ..\..\Calibration Results Sheets\Current Approved Results Sheets\NL-31 Master 61672-3 Approved Issue 5 (BK 2590976).xls Test procedures in accordance with BS EN 61672-3:2006. NOTE: Test 10.1 (Self Generated Noise with Microphone Installed) omitted.
Test Engineer	Ben MacIsaac

APPROVED SIGNATORY .....

Les Jephson ☒ / Mike Breslin ☐

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Measurement Systems

CERTIFICATE OF CALIBRATION

Certificate Number	**CAL090902**
Date of Issue	**02/09/2009**
Customer	**Addiscombe EC Ltd**

	Manufacturer	**Type**	**Serial Number**
Sound Level Meter	Rion	NA-27	00121720
Microphone	Rion	UC-53A	308435
Pre Amplifier	Rion	NH-20	46012

This equipment has been calibrated and tested for compliance with Manufacturer's Performance Specifications.

Notes
Instrument Firmware version 2.0.

Conditions	Measured Value
Temperature	23.0°C
Relative Humidity	42.7%
Atmospheric Pressure	99.97kPa

ANV Measurement Systems' Calibration Laboratory electroacoustic test equipment is fully traceable to national standards. Additional electronic and ancillary equipment used in the procedures has been calibrated to a certified degree of accuracy that ensures that any additional uncertainties are minimal.

Tests were carried out in controlled environmental conditions to the extent that extraneous environmental factors will have had no substantial effect on the measured parameters in comparison to the tolerances required to unequivocally determine compliance with the manufacturer's specifications.

The total expanded measurement uncertainties associated with the calibration equipment and procedures provide a confidence of approximately 95% in the results. The assessment of uncertainty has been carried out in accordance with national and international guidance upon the calculation of uncertainties in metrology.

Signed..... Position...DIRECTOR... Date...7/9/09...

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Measurement Systems

CERTIFICATE OF CALIBRATION

Certificate Number	**CAL090901**
Date of Issue	**01/09/2009**
Customer	**Addiscombe EC Ltd**
	Description of Instrument
Calibrator	Rion NC-74 [Serial No. 00110080] With ½" adaptor type NC-74-002 fitted.
Date of Calibration	01/09/2009.
Test Procedure	..\..\Calibration Procedures\Current Approved Procedures\NC_74_Cal Procedure Approved Isue 1.xls ..\..\Calibration Results Sheets\Current Approved Results Sheets\NC-74 Master 60942 Approved Issue 2 (BK 2590976).xls Test procedures in accordance with BS EN 60942: 2003 (Annex B)
Test Engineer	Amrat Patel

APPROVED SIGNATORY .....
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APPENDIX B

Noise Monitoring Results

Table B1 : Background Noise Measurements

Noise Monitoring Results

Project Number: **1313**
Location: **1m From Air Condenser Unit, 54 Aberdare Gardens**
Date: **02/08/2010**
Personnel: **Edward Crofton-Martin**
Height Above Ground: **1.5m**

Equipment

Type	Description	S/n
Rion NL-32	Sound Level Meter	00640762
Rion NH-21	Pre-Amplifier	306634
Rion UC-53A	Microphone	11822
Rion NC-74	Sound Level Calibrator	00110080

Calibration

Calibration prior to survey re 94.0 dB	94.0
Calibration after survey re 94.0 dB	94.0

Background noise measurements - without fan operating

Date / Time	Location	Duration	LAeq	LAmax	LA10	LA90
02/08/2010 07:52	1m from window of nearest receptor	5 Mins	44.2	67.9	44.8	39.9
02/08/2010 07:57	1m from window of nearest receptor	5 Mins	45.2	67.2	45.2	39.7
02/08/2010 08:02	1m from window of nearest receptor	5 Mins	48.4	76.6	47.9	40.2
02/08/2010 08:07	1m from window of nearest receptor	5 Mins	42.5	52.3	44.6	39.8
02/08/2010 08:12	1m from window of nearest receptor	5 Mins	43.5	53.0	45.3	40.6
02/08/2010 08:17	1m from window of nearest receptor	5 Mins	42.7	49.3	44.5	40.2
02/08/2010 08:22	1m from window of nearest receptor	5 Mins	45.5	57.4	47.7	41.6
02/08/2010 08:27	1m from window of nearest receptor	5 Mins	45.9	57.5	48.1	42.4
02/08/2010 08:32	1m from window of nearest receptor	5 Mins	45.5	54.9	48.3	41.1
02/08/2010 08:37	1m from window of nearest receptor	5 Mins	44.3	55.3	46.5	40.4
02/08/2010 08:42	1m from window of nearest receptor	5 Mins	46.4	66.2	45.8	41.7
02/08/2010 08:47	1m from window of nearest receptor	5 Mins	42.7	50.6	44.0	40.7
02/08/2010 08:52	1m from window of nearest receptor	5 Mins	42.8	51.2	44.0	40.8

Date / Time	Location	Duration	LAeq	LAmax	LA10	LA90
08:57:05	1m from window of nearest receptor	5 Mins	43.1	55.2	45.2	39.6
09:02:05	1m from window of nearest receptor	5 Mins	42.2	52.1	44.5	39.1
09:07:05	1m from window of nearest receptor	5 Mins	55.8	72.2	52.8	39.9
09:12:05	1m from window of nearest receptor	5 Mins	43.4	54.9	46.6	37.9
09:17:05	1m from window of nearest receptor	5 Mins	42.8	54.7	45.4	38.4
09:22:05	1m from window of nearest receptor	5 Mins	43.2	55.5	46.1	38.4
09:27:05	1m from window of nearest receptor	5 Mins	46.0	61.4	48.0	40.0
09:32:05	1m from window of nearest receptor	5 Mins	43.2	55.5	46.2	38.9
09:37:05	1m from window of nearest receptor	5 Mins	44.2	55.8	48.2	38.8
09:42:05	1m from window of nearest receptor	5 Mins	42.6	53.6	45.7	39.0
09:47:05	1m from window of nearest receptor	5 Mins	43.6	57.5	46.3	39.2
09:52:05	1m from window of nearest receptor	5 Mins	40.0	47.1	42.2	37.0
09:57:05	1m from window of nearest receptor	5 Mins	43.5	56.4	46.4	39.5
10:02:05	1m from window of nearest receptor	5 Mins	51.6	67.9	55.5	38.9
10:07:05	1m from window of nearest receptor	5 Mins	47.1	58.5	50.7	39.4
10:12:05	1m from window of nearest receptor	5 Mins	44.7	58.5	46.5	40.2
10:17:05	1m from window of nearest receptor	5 Mins	43.3	57.4	44.6	39.7
10:22:05	1m from window of nearest receptor	5 Mins	43.1	57.1	43.9	39.6
10:27:05	1m from window of nearest receptor	5 Mins	42.6	59.6	44.2	39.5
10:32:05	1m from window of nearest receptor	5 Mins	45.3	57.5	48.3	41.2
10:37:05	1m from window of nearest receptor	5 Mins	52.5	66.0	56.2	41.2
10:42:05	1m from window of nearest receptor	5 Mins	47.4	64.6	50.7	41.7
10:47:05	1m from window of nearest receptor	5 Mins	44.7	60.9	44.8	40.0
10:52:05	1m from window of nearest receptor	5 Mins	45.2	70.4	45.9	38.6
10:57:05	1m from window of nearest receptor	5 Mins	48.6	66.8	51.9	40.8
11:02:05	1m from window of nearest receptor	5 Mins	46.9	65.4	49.5	40.4
11:07:05	1m from window of nearest receptor	5 Mins	41.3	52.6	44.0	38.4
11:12:05	1m from window of nearest receptor	5 Mins	44.5	56.8	47.0	40.1
11:17:05	1m from window of nearest receptor	5 Mins	43.7	57.8	45.7	40.1
11:22:05	1m from window of nearest receptor	5 Mins	41.4	53.6	43.7	38.3
11:27:05	1m from window of nearest receptor	5 Mins	42.4	56.5	44.1	38.5
11:32:05	1m from window of nearest receptor	5 Mins	43.8	51.8	46.2	40.5
11:37:05	1m from window of nearest receptor	5 Mins	44.4	53.0	46.9	40.8
11:42:05	1m from window of nearest receptor	5 Mins	52.7	62.4	55.3	46.8
11:47:05	1m from window of nearest receptor	5 Mins	52.4	59.3	55.1	44.9
11:52:05	1m from window of nearest receptor	5 Mins	52.4	61.3	57.0	43.0
11:57:05	1m from window of nearest receptor	5 Mins	49.1	61.0	51.3	45.5
12:02:05	1m from window of nearest receptor	5 Mins	46.1	52.5	48.9	41.8

Date / Time	Location	Duration	LAeq	LAmax	LA10	LA90
12:07:05	1m from window of nearest receptor	5 Mins	46.2	58.3	49.3	40.0
12:12:05	1m from window of nearest receptor	5 Mins	44.9	50.9	46.8	41.6
12:17:05	1m from window of nearest receptor	5 Mins	45.8	53.0	47.9	42.8
12:22:05	1m from window of nearest receptor	5 Mins	45.7	57.9	48.0	42.1
12:27:05	1m from window of nearest receptor	5 Mins	43.5	53.0	45.9	40.2
12:32:05	1m from window of nearest receptor	5 Mins	42.7	53.2	43.9	40.3
12:37:05	1m from window of nearest receptor	5 Mins	43.0	55.0	44.6	40.3
12:42:05	1m from window of nearest receptor	5 Mins	45.0	52.4	47.7	41.9
12:47:05	1m from window of nearest receptor	5 Mins	46.1	55.3	47.7	43.6
12:52:05	1m from window of nearest receptor	5 Mins	44.4	49.5	46.7	42.0
12:57:05	1m from window of nearest receptor	5 Mins	44.8	62.4	46.2	41.5
13:02:05	1m from window of nearest receptor	5 Mins	43.7	59.1	45.4	41.2
13:07:05	1m from window of nearest receptor	5 Mins	44.9	65.0	45.5	39.7
13:12:05	1m from window of nearest receptor	5 Mins	42.6	48.6	44.9	39.5
13:17:05	1m from window of nearest receptor	5 Mins	47.4	64.6	47.4	39.6
13:22:05	1m from window of nearest receptor	5 Mins	44.7	57.4	46.3	40.6
13:27:05	1m from window of nearest receptor	5 Mins	49.9	68.4	51.6	42.6
13:32:05	1m from window of nearest receptor	5 Mins	45.1	57.1	46.7	42.6
13:37:05	1m from window of nearest receptor	5 Mins	48.7	64.2	50.1	45.4
13:42:05	1m from window of nearest receptor	5 Mins	49.7	65.4	50.8	43.8
13:47:05	1m from window of nearest receptor	5 Mins	47.9	63.8	50.1	42.5
13:52:05	1m from window of nearest receptor	5 Mins	44.6	54.4	47.8	40.8
13:57:05	1m from window of nearest receptor	5 Mins	42.9	53.4	46.6	39.0
14:02:05	1m from window of nearest receptor	5 Mins	44.4	53.8	46.5	40.6
14:07:05	1m from window of nearest receptor	5 Mins	42.5	51.5	45.0	39.4
14:12:05	1m from window of nearest receptor	5 Mins	52.4	68.2	56.0	42.1
14:17:05	1m from window of nearest receptor	5 Mins	44.0	60.6	45.6	40.4
14:22:05	1m from window of nearest receptor	5 Mins	53.5	70.3	56.0	41.1
14:27:05	1m from window of nearest receptor	5 Mins	51.4	67.2	53.4	41.8
14:32:05	1m from window of nearest receptor	5 Mins	48.5	65.4	52.2	40.1
14:37:05	1m from window of nearest receptor	5 Mins	46.4	63.1	49.2	40.3
14:42:05	1m from window of nearest receptor	5 Mins	48.2	69.1	50.0	42.6
14:47:05	1m from window of nearest receptor	5 Mins	48.5	72.6	47.7	40.8
14:52:05	1m from window of nearest receptor	5 Mins	47.0	72.4	46.7	41.0
14:57:05	1m from window of nearest receptor	5 Mins	48.6	69.6	48.3	41.5
15:02:05	1m from window of nearest receptor	5 Mins	48.7	70.3	46.4	40.2
15:07:05	1m from window of nearest receptor	5 Mins	50.1	73.7	48.0	39.7
15:12:05	1m from window of nearest receptor	5 Mins	46.1	71.7	46.4	41.3

Date / Time	Location	Duration	LAeq	LAmax	LA10	LA90
15:17:05	1m from window of nearest receptor	5 Mins	44.2	61.6	45.4	38.5
15:22:05	1m from window of nearest receptor	5 Mins	49.1	64.4	52.1	41.2
15:27:05	1m from window of nearest receptor	5 Mins	49.2	62.9	52.8	41.8
15:32:05	1m from window of nearest receptor	5 Mins	49.8	69.7	51.8	42.5
15:37:05	1m from window of nearest receptor	5 Mins	53.1	75.5	54.6	40.4
15:42:05	1m from window of nearest receptor	5 Mins	50.3	69.5	53.5	41.4
15:47:05	1m from window of nearest receptor	5 Mins	49.9	64.9	53.3	40.8
15:52:05	1m from window of nearest receptor	5 Mins	48.8	68.2	50.9	40.0
15:57:05	1m from window of nearest receptor	5 Mins	47.6	68.3	46.8	39.5
16:02:05	1m from window of nearest receptor	5 Mins	49.5	68.2	51.7	40.7
16:07:05	1m from window of nearest receptor	5 Mins	45.2	63.7	46.5	39.7
16:12:05	1m from window of nearest receptor	5 Mins	46.4	59.7	48.5	42.7
16:17:05	1m from window of nearest receptor	5 Mins	45.7	65.3	48.3	39.0
16:22:05	1m from window of nearest receptor	5 Mins	50.2	73.9	45.9	38.4
16:27:05	1m from window of nearest receptor	5 Mins	42.1	54.1	44.8	38.1
16:32:05	1m from window of nearest receptor	5 Mins	47.3	61.6	50.8	40.5
16:37:05	1m from window of nearest receptor	5 Mins	44.4	61.2	45.3	39.9
16:42:05	1m from window of nearest receptor	5 Mins	42.7	55.2	45.3	38.8
16:47:05	1m from window of nearest receptor	5 Mins	52.1	74.4	48.3	38.3
16:52:05	1m from window of nearest receptor	5 Mins	50.6	66.2	54.7	39.9
16:57:05	1m from window of nearest receptor	5 Mins	46.2	61.2	49.0	39.7
17:02:05	1m from window of nearest receptor	5 Mins	44.2	56.1	46.6	40.6
17:07:05	1m from window of nearest receptor	5 Mins	43.5	55.7	46.5	38.9
17:12:05	1m from window of nearest receptor	5 Mins	44.4	59.0	47.2	40.1
17:17:05	1m from window of nearest receptor	5 Mins	42.5	51.7	44.3	39.8
17:22:05	1m from window of nearest receptor	5 Mins	46.3	65.6	45.2	38.8
17:27:05	1m from window of nearest receptor	5 Mins	55.3	75.3	54.9	37.2
17:32:05	1m from window of nearest receptor	5 Mins	42.2	59.4	44.0	37.9
17:37:05	1m from window of nearest receptor	5 Mins	46.5	63.0	48.7	38.8
17:42:05	1m from window of nearest receptor	5 Mins	43.4	57.8	45.7	39.3
17:47:05	1m from window of nearest receptor	5 Mins	43.2	53.7	44.9	40.5
17:52:05	1m from window of nearest receptor	5 Mins	42.4	57.2	44.2	39.2
17:57:05	1m from window of nearest receptor	5 Mins	45.1	59.1	47.0	40.8
18:02:05	1m from window of nearest receptor	5 Mins	47.5	65.1	47.9	42.4
18:07:05	1m from window of nearest receptor	5 Mins	48.8	65.9	49.5	39.9
18:12:05	1m from window of nearest receptor	5 Mins	43.7	55.7	45.3	41.3
18:17:05	1m from window of nearest receptor	5 Mins	49.6	67.3	51.3	45.0
18:22:05	1m from window of nearest receptor	5 Mins	50.1	65.3	52.5	42.8

Date / Time	Location	Duration	LAeq	LAmax	LA10	LA90
18:27:05	1m from window of nearest receptor	5 Mins	44.0	62.4	45.6	41.6
18:32:05	1m from window of nearest receptor	5 Mins	46.8	60.8	49.1	42.5
18:37:05	1m from window of nearest receptor	5 Mins	48.9	70.5	49.3	41.4
18:42:05	1m from window of nearest receptor	5 Mins	45.6	59.2	47.7	42.3
18:47:05	1m from window of nearest receptor	5 Mins	47.6	66.7	47.1	41.6
18:52:05	1m from window of nearest receptor	5 Mins	49.1	64.7	51.4	42.2
18:57:05	1m from window of nearest receptor	5 Mins	48.1	62.4	52.1	43.0
19:02:05	1m from window of nearest receptor	5 Mins	44.1	56.0	46.6	41.1
19:07:05	1m from window of nearest receptor	5 Mins	42.7	52.9	44.5	40.5
19:12:05	1m from window of nearest receptor	5 Mins	44.3	60.9	46.8	40.0
19:17:05	1m from window of nearest receptor	5 Mins	43.2	54.7	45.2	40.0
19:22:05	1m from window of nearest receptor	5 Mins	46.6	62.9	49.5	40.8
19:27:05	1m from window of nearest receptor	5 Mins	44.8	61.8	47.3	40.9
19:32:05	1m from window of nearest receptor	5 Mins	45.4	60.0	48.2	40.9
19:37:05	1m from window of nearest receptor	5 Mins	46.8	63.2	49.1	41.3
19:42:05	1m from window of nearest receptor	5 Mins	49.3	63.3	52.8	43.5
19:47:05	1m from window of nearest receptor	5 Mins	43.1	51.4	44.6	41.3
19:52:05	1m from window of nearest receptor	5 Mins	42.8	51.5	44.5	40.5
19:57:05	1m from window of nearest receptor	5 Mins	42.8	49.9	44.6	40.4
20:02:05	1m from window of nearest receptor	5 Mins	41.9	61.8	43.6	38.5
20:07:05	1m from window of nearest receptor	5 Mins	43.1	52.8	45.6	38.7
20:12:05	1m from window of nearest receptor	5 Mins	42.7	56.1	44.7	39.2
20:17:05	1m from window of nearest receptor	5 Mins	43.7	58.3	46.0	39.4
20:22:05	1m from window of nearest receptor	5 Mins	42.4	50.6	44.5	38.8
20:27:05	1m from window of nearest receptor	5 Mins	45.4	58.2	49.1	39.5
20:32:05	1m from window of nearest receptor	5 Mins	44.6	53.9	46.7	41.5
20:37:05	1m from window of nearest receptor	5 Mins	45.4	61.9	46.3	39.9
20:42:05	1m from window of nearest receptor	5 Mins	44.9	60.5	48.1	39.1
20:47:05	1m from window of nearest receptor	5 Mins	42.5	64.1	44.3	39.1
20:52:05	1m from window of nearest receptor	5 Mins	45.2	69.0	44.8	38.7
20:57:05	1m from window of nearest receptor	5 Mins	41.6	59.3	43.5	38.1
21:02:05	1m from window of nearest receptor	5 Mins	40.5	44.1	42.2	38.9

Table B2 : Source Term Noise Measurements of Condenser Unit

Equipment

Type	Description	S/n
Rion NA-27	Sound Level Meter	121720
Rion NH-20	Pre-Amplifier	46012
Rion UC-53a	Microphone	308435
Rion NC-74	Sound Level Calibrator	00110080

Measured Unweighted 1/3 Octave band levels noise levels dB (Leq)

Frequency	12.5 Hz	16 Hz	20 Hz	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz
Level dB at 0.1m	53.1	51.1	48.4	49.7	71.2	63.9	47.5	51.2	47.3	49.7	47.3	48.0	46.2
Level dB at 0.1m	55.1	48.4	47.0	48.1	67.0	60.0	49.4	51.5	48.2	50.8	47.4	47.4	46.2
Level dB at 0.1m	49.8	47.2	45.6	48.8	71.7	64.4	47.7	52.6	47.8	49.4	46.6	47.4	46.1
Level dB at 0.1m	73.3	74.3	75.5	75.6	81.1	75.5	68.5	66.9	63.4	59.2	56.4	54.6	53.2
Level dB at 0.1m	76.3	75.5	73.8	73.8	83.6	76.8	66.2	63.7	59.5	56.5	57.1	53.5	52.6
Level dB at 0.1m	75.7	73.4	69.3	66.0	68.7	62.1	55.0	54.7	51.0	55.3	56.0	53.3	51.7
Level dB at 0.1m	72.8	72.7	70.8	69.3	77.5	71.1	62.6	62.8	58.0	57.6	54.8	52.7	51.0
Level dB at 0.1m	70.7	70.6	71.2	68.3	70.3	66.1	62.3	61.5	57.3	56.1	54.4	52.0	51.5
Level dB at 0.1m	50.8	48.2	50.1	46.8	61.4	54.5	45.2	53.7	50.0	49.2	47.8	49.8	47.9
Average	**71.7**	**71.1**	**70.2**	**69.5**	**77.1**	**70.8**	**62.3**	**61.1**	**57.1**	**55.2**	**53.8**	**51.7**	**50.4**

Frequency	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz
Level dB at 0.1m	45.5	39.5	40.9	41.9	41.1	39.5	38.4	36.5	34.9	32.4	30.4	27.8	24.6
Level dB at 0.1m	44.9	38.8	39.2	42.4	42.5	39.4	38.9	37.2	35.3	32.3	30.2	27.6	24.3
Level dB at 0.1m	45.9	39.1	41.2	42.1	40.7	40.0	38.7	36.1	34.8	32.5	30.6	27.9	24.5
Level dB at 0.1m	50.6	50.3	49.2	50.2	48.9	47.1	45.2	43.6	41.8	40.9	38.2	35.4	32.4
Level dB at 0.1m	51.0	49.8	48.3	47.6	46.2	45.7	44.1	42.7	41.5	39.6	37.4	34.7	31.3
Level dB at 0.1m	50.8	49.0	48.3	47.5	45.7	44.1	45.3	43.7	42.1	40.7	37.9	35.3	31.8
Level dB at 0.1m	49.2	48.2	48.2	48.1	46.0	44.8	43.9	42.5	41.2	39.6	37.2	34.5	31.3
Level dB at 0.1m	49.6	47.8	48.1	48.7	46.4	45.3	44.2	42.9	41.7	39.7	37.8	35.0	31.7
Level dB at 0.1m	47.3	46.3	44.1	43.2	41.7	39.6	38.5	36.8	35.1	33.4	29.7	26.3	23.0
Average	**48.9**	**47.2**	**46.6**	**46.8**	**45.2**	**43.8**	**42.8**	**41.3**	**39.8**	**38.2**	**35.7**	**33.0**	**29.7**

Frequency	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz
Level dB at 0.1m	22.0	20.7	20.7	21.0	22.5
Level dB at 0.1m	21.3	20.3	20.3	21.1	22.4
Level dB at 0.1m	22.2	20.7	20.7	21.0	22.5
Level dB at 0.1m	28.7	25.0	21.7	21.4	24.4
Level dB at 0.1m	27.5	24.1	21.2	21.9	24.4
Level dB at 0.1m	28.5	25.1	22.4	23.2	25.3
Level dB at 0.1m	27.8	24.2	21.5	22.9	24.5
Level dB at 0.1m	28.1	24.5	22.3	22.9	24.7
Level dB at 0.1m	20.6	17.8	17.7	20.7	22.1
Average	**26.3**	**23.1**	**21.1**	**21.9**	**23.8**

Table B3 : Background Noise Measurements with Unit Operating

Calibration

Calibration prior to survey re 94.0 dB	94.0
Calibration after survey re 94.0 dB	94.0

Background noise measurements - fan operating

Date / Time	Location	Duration	LAeq	LAmax	LA10	LA90
02/08/2010 21:10:13	1m from window of nearest receptor	5 mins	42.2	56.4	43.0	41.0
02/08/2010 21:15:13	1m from window of nearest receptor	5 mins	41.9	50.0	43.0	40.7
02/08/2010 21:20:13	1m from window of nearest receptor	5 mins	51.5	67.5	54.9	40.7