

**NOISE ASSESSMENT FOR SIX PRE-SELECTED SITES AT
BODLES, ST. CATHERINE**

R E P O R T

N O V E M B E R 2 0 1 0

Submitted to:

EnviroPlanners Ltd.
17 Munroe Road, Kgn 6
Jamaica, W.I.



Taking Care of You and Your Environment.

REPORT

NOISE ASSESSMENT FOR SIX PRE-SELECTED SITES AT BODLES, ST. CATHERINE

Submitted to
ENVIROPLANNERS LTD.
17 Munroe Road. Kingston. 6
Jamaica, W.I.

Submitted by
C.L. ENVIRONMENTAL COMPANY LIMITED
22 Fort George Heights, Stony Hill
Kingston 9
Constant Spring P. O. Box 2919

NOVEMBER 2010

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1.0 INTRODUCTION

This report was prepared as a request from Mr Timon Waugh, Environmental Manager, Enviro Planners Ltd. to do the noise assessment of six (6) pre-selected locations in the Bodles area in St. Catherine. The noise assessment was conducted from Tuesday November 23rd, 2010 at 7:00pm to Wednesday November 24th, 2010 at 6:00pm. Six (6) stations were monitored over a twenty four hour (24 hour) period.

1.1 TERMS OF REFERENCE

The following Terms of Reference were developed by the Consultant.

1. To provide labour, supervision, equipment, materials and transportation to carry out noise assessment over a 24-hour period with an interval of 10 seconds between measurements.
2. The noise levels shall be measured in low, mid and high frequency bands in order to clearly define the noise.
3. A defined map of each location clearly outlined in metric shall be prepared and included in the report. The total number of data collection sites shall be 6.
4. To prepare and present a full report.

The report will contain the following information:

- (i) Dates, times and places of test.
- (ii) Test Method used.
- (iii) Copies of instrumentation calibration certificate (Appendix 1).
- (iv) Noise level measurements
- (v) Any other relevant operating information.

1.2 STUDY TEAM

Mr Carlton Campbell (M.Phil.) - Environmental Scientist

Mr Glen Patrick - Technical Assistant

Mr Errol Harrison - Technical Assistant

2.0 METHODOLOGY

The noise assessment was conducted from Tuesday November 23rd, 2010 at 7:00pm to Wednesday November 24th, 2010 at 6:00pm. Four (4) stations (Stations 1, 3, 4 and 6) were monitored over a twenty four hour (24 hour) period. Monitoring at Station 2 (7 hours) and Station 5 (53 minutes) was a result of battery malfunction.

The descriptions, GPS locations in (JAD2001 and Latitude and Longitude coordinate systems) of these noise stations are listed in Table 1 and depicted in Figure 1.

Table 1 Station numbers and locations in JAD2001 and Latitude/Longitude

| STATIONS | JAD 2001 (m) | | LAT/LONG (DECIMAL DEGREES) | |
|----------|--------------|------------|----------------------------|---------|
| | E | N | N | W |
| STN 1 | 735715.747 | 641598.378 | 17.924 | -77.135 |
| STN 2 | 736397.807 | 641582.187 | 17.924 | -77.128 |
| STN 3 | 736183.272 | 641106.566 | 17.920 | -77.130 |
| STN 4 | 735820.991 | 640748.333 | 17.916 | -77.134 |
| STN 5 | 735410.136 | 641025.609 | 17.919 | -77.138 |
| STN 6 | 734944.635 | 641015.490 | 17.919 | -77.142 |

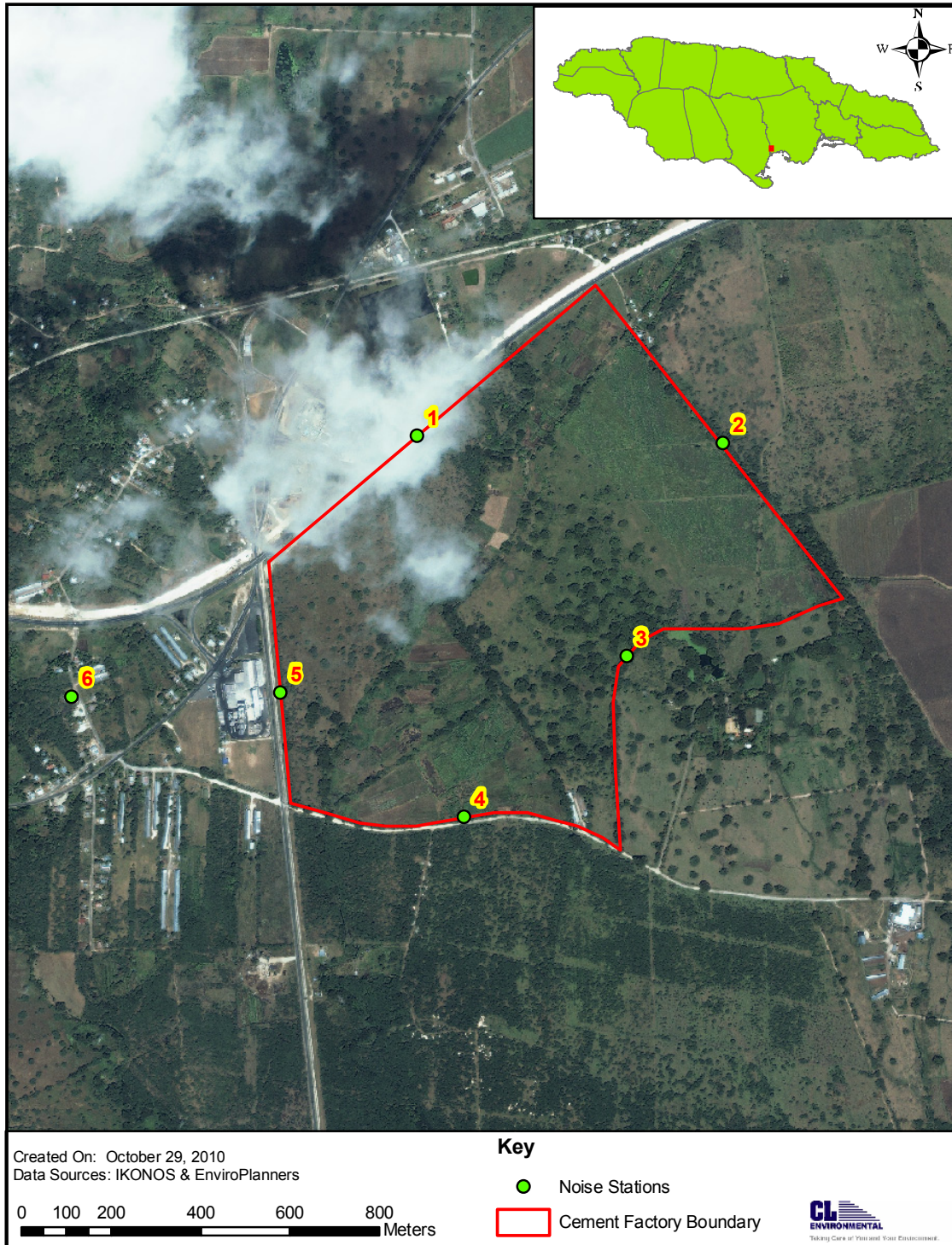


Figure 1 Map depicting station locations

2.1 NOISE LEVEL READINGS AND OCTAVE BAND ANALYSIS

Noise level readings were taken by using Quest Technologies SoundPro DL Type 1 hand held sound level meters with real time frequency analyzer setup in an outdoor monitoring kit. The octave band analysis was conducted concurrently with the noise level measurements. Measurements were taken in the third octave which provided thirty three (33) octave bands from 12.5 Hz to 20 kHz (low, medium and high frequency bands).

The noise meters were calibrated pre and post noise assessment by using a Quest QC - 10 sound calibrator. The meters were programmed using the Quest suite Professional II (QSP II) software to collect third octave, average sound level (Leq) over the period, Lmin (The lowest level measured during the assessment) and Lmax (The highest level measured during the assessment) every ten seconds.

Average noise levels over the period were calculated within the QSP II software using the formula;

$$\text{Average dBA} = 20 \log \frac{1}{N} \sum_{j=1}^N 10^{(L_j/20)}$$

where N = number of measurements, L_j = the j th sound level and $j = 1, 2, 3 \dots N$.

Six (6) noise meters with outdoor monitoring kits were set up, one each at each location listed in Table 1. These meters were left for the entire twenty-four (24) hour assessment period in an outdoor measuring system and programmed to collect data every 10 seconds.

A windscreen (sponge) was placed over the microphone to prevent measurement errors due to noise caused by wind blowing across the microphone. The microphone of the meters was at a height of approximately 1.5m above ground. There were no vertical reflecting surfaces within 3 m (10 feet) of the microphone.

3.0 RESULTS

This section outlines the results of the twenty four (24) hour noise monitoring exercise at the six (6) monitoring stations.

3.1 STATION 1

During the 24-hour period, noise levels at this station ranged from a low (Lmin) of 37.0 dBA to a high (Lmax) of 78.0 dBA. Average noise level for this period was 56.1 L_{Aeq} (24h). The fluctuation in noise levels over the 24 hour period is depicted in Figure 2.

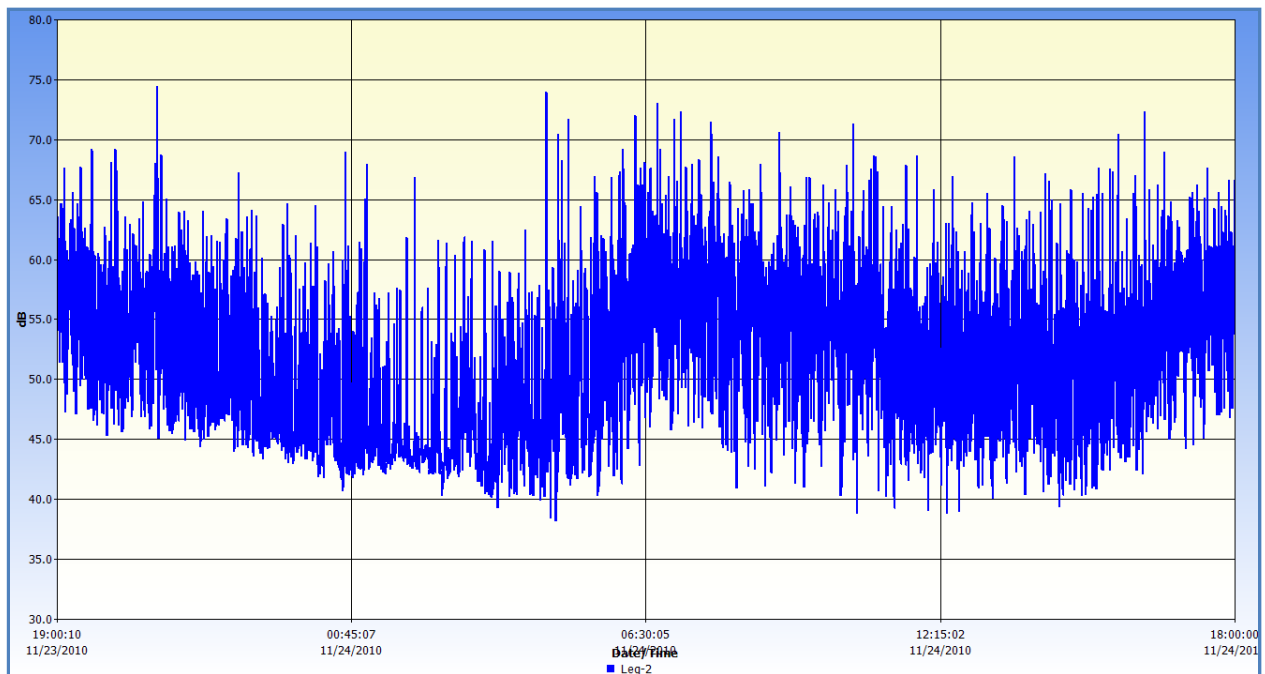


Figure 2 Noise fluctuation (Leq) over 24 hours at Station 1

3.1.1 Octave Band Analysis at Station 1

The noise at this station during the 24 hour period was in the low frequency band centred around the geometric mean frequency of 80 Hz. (octave frequency range is 71 - 90 Hz) (Figure 3). Although the noise was centred around the 80 Hz frequency, there was also noise emitted in the 500 Hz, 6.3 kHz and 12.5 kHz frequencies.

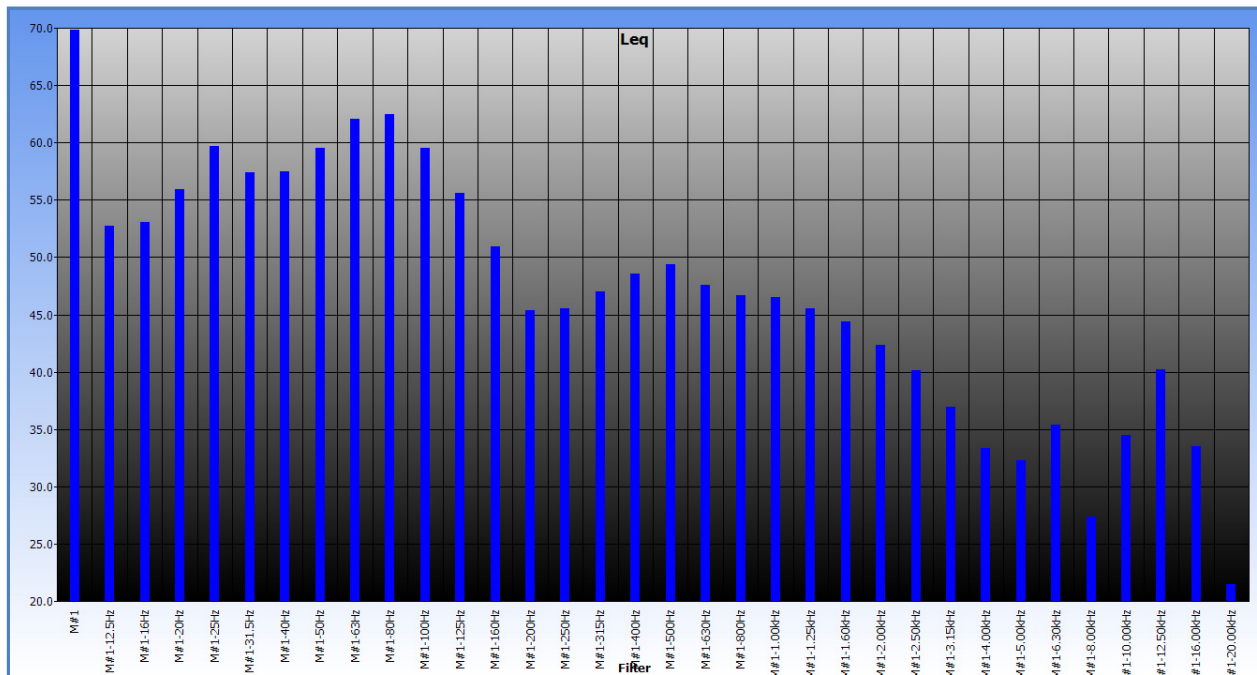


Figure 3 Octave band spectrum of noise at Station 1

3.1.2 L10 and L90

The two most common L_n values used are L_{10} and L_{90} and these are sometimes called the 'annoyance level' and 'background level' respectively. L_{10} is almost the only statistical value used for the descriptor of the higher levels, but L_{90} , is widely used to describe the ambient or background level. L_{10} - L_{90} is often used to give a quantitative measure as to the spread or "how choppy" the sound was.

L_{10} is the noise level exceeded for 10% of the time of the measurement duration. This is often used to give an indication of the upper limit of fluctuating noise, such as that from road traffic. L_{90} is the noise level exceeded for 90% of the time of the measurement duration.

The difference between L_{10} and L_{90} gives an indication of the noise climate. When the difference is < 5 dBA then it is considered that there are no significant fluctuations in the noise climate, moderate fluctuations 5-15 dBA and large fluctuations >15 dBA.

Figure 4 depicts the hourly L_{10} and L_{90} statistics for this station over the noise assessment period. The data shows moderate fluctuations ($L_{10} - L_{90}$) (~95.7% of the time) in the noise climate at this station. The largest fluctuations happened at 4 am and 5 am.

The overall L_{10} and L_{90} at this station for the time assessed were 59.7 dBA and 43.5 dBA respectively.

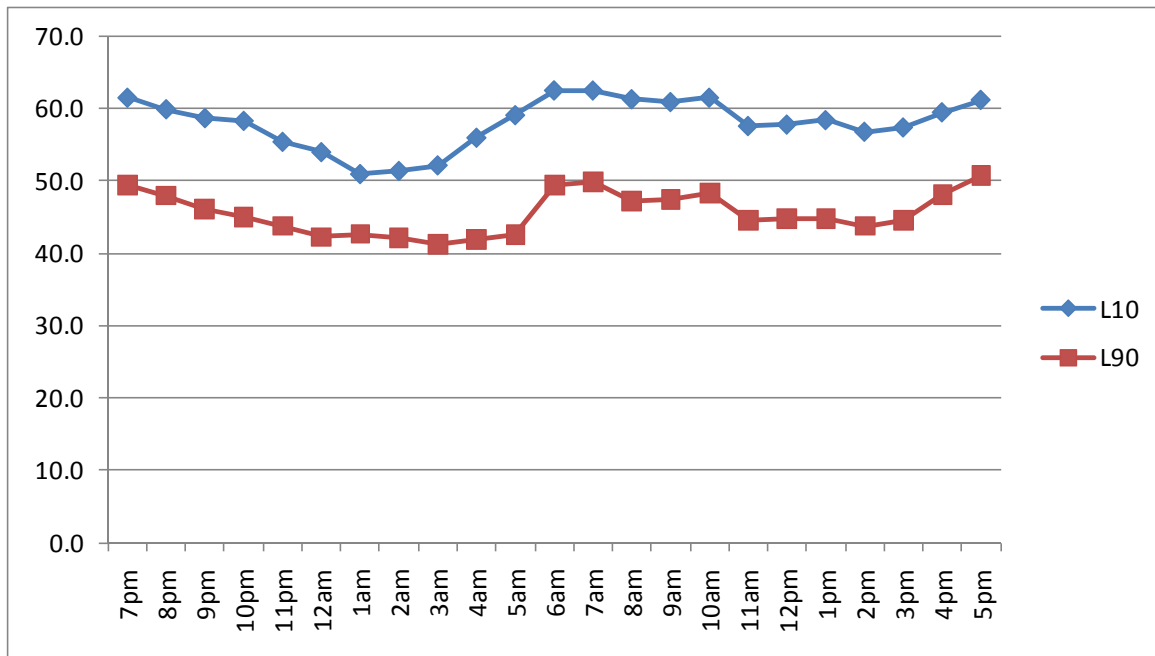


Figure 4 L10 and L90 for Station 1

3.2 STATION 2

During the 7-hour period, noise levels at this station ranged from a low (Lmin) of 35.7 dBA to a high (Lmax) of 64.1 dBA. Average noise level for this period was 45.8 L_{Aeq} (7h). The fluctuation in noise levels over the 7 hour period is depicted in Figure 5.

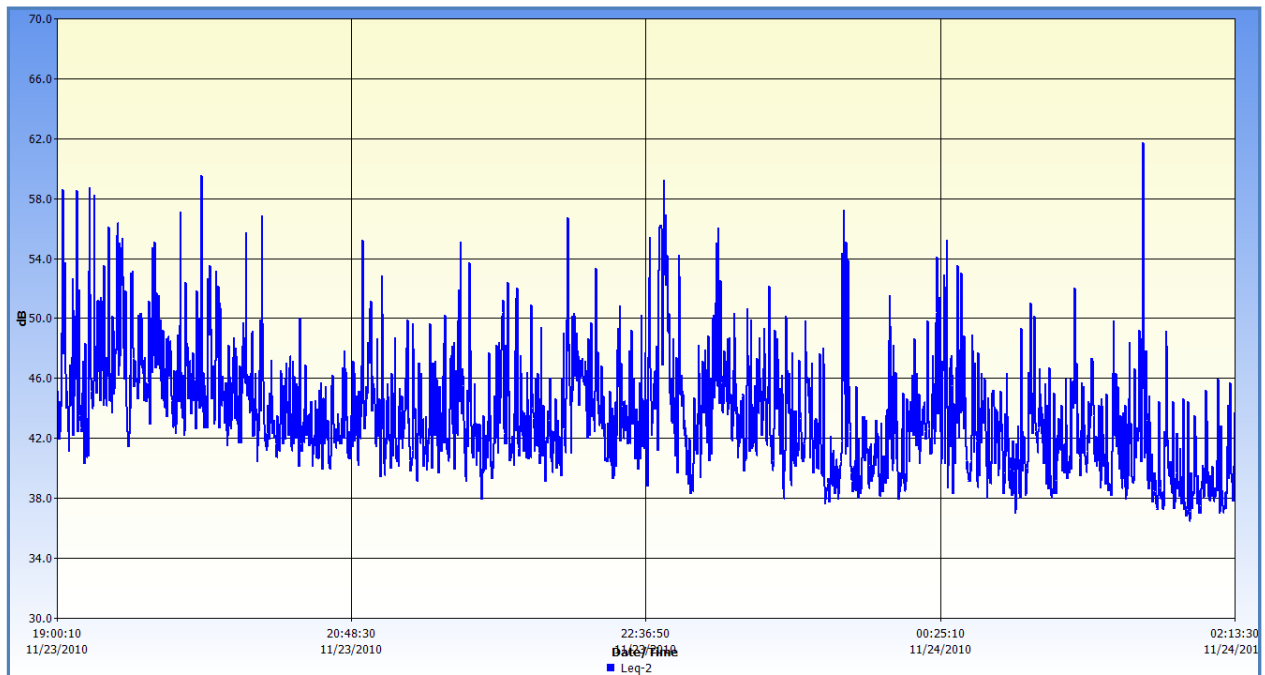


Figure 5 Noise fluctuation (Leq) over 7 hours at Station 2

3.2.1 Octave Band Analysis at Station 2

The noise at this station during the 7 hour period was in the low frequency band centred around the geometric mean frequency of 25 Hz. (octave frequency range is 22 -28 Hz) (Figure 6). Although the noise was centred around the 25 Hz frequency, there was also noise emitted in the 50 Hz, 250 Hz, 6.3 kHz and 12.5 kHz frequencies.

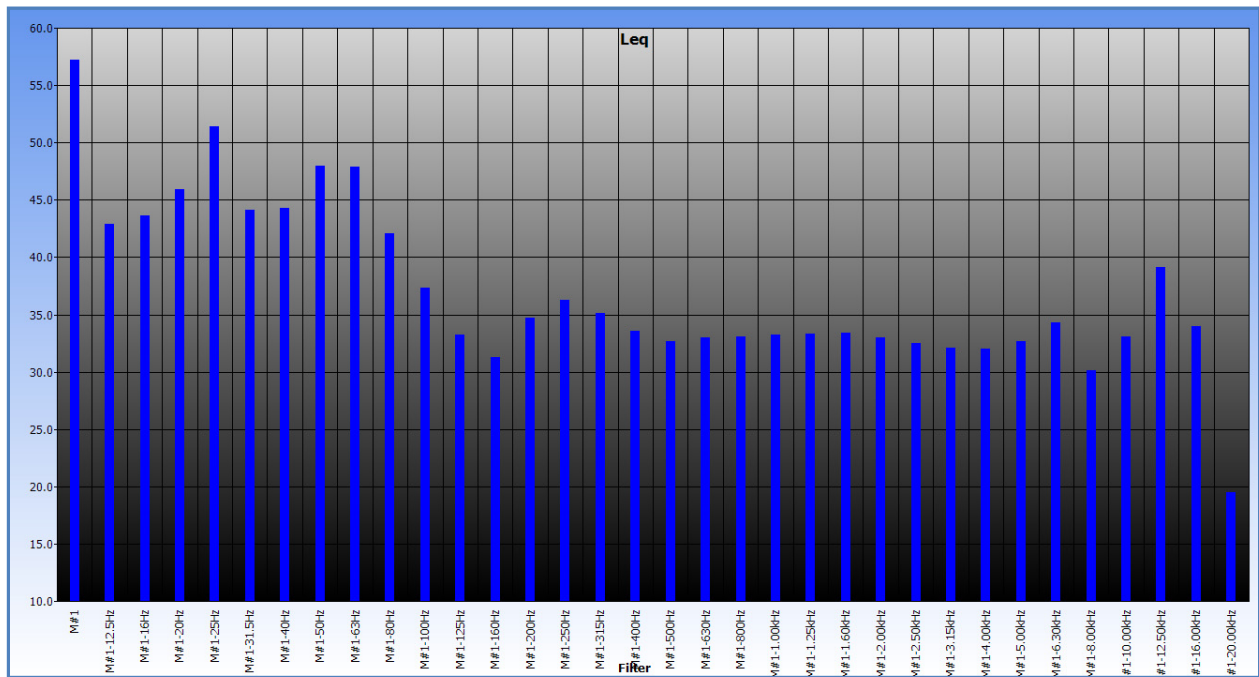


Figure 6 Octave band spectrum of noise at Station 2

3.2.2 L10 and L90

Figure 7 depicts the hourly L10 and L90 statistics for this station over the noise assessment period. The data shows moderate fluctuations (L10 – L90) (~97.5% of the time) in the noise climate at this station. The largest fluctuations happened at 10 pm and 11 pm.

The overall L10 and L90 at this station for the time assessed were 48.4 dBA and 39.1 dBA respectively.

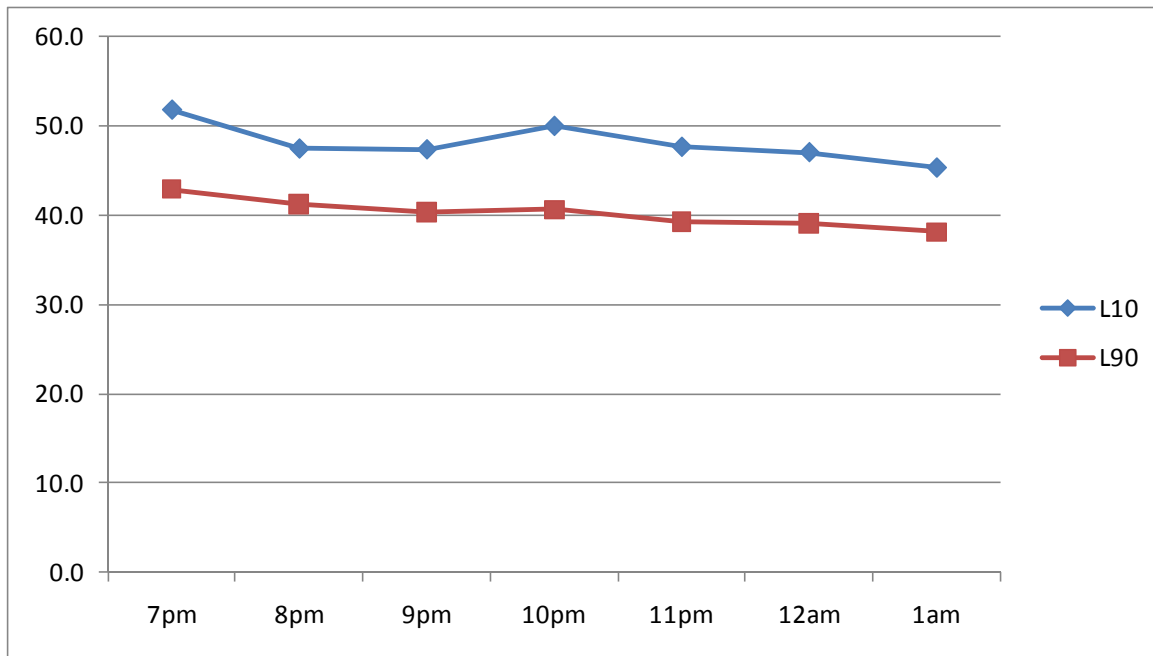


Figure 7 L10 and L90 for Station 2

3.3 STATION 3

During the 24-hour period, noise levels at this station ranged from a low (Lmin) of 32.6 dBA to a high (Lmax) of 61.7 dBA. Average noise level for this period was 47.6 L_{Aeq} (24h). The fluctuation in noise levels over the 24 hour period is depicted in Figure 8.

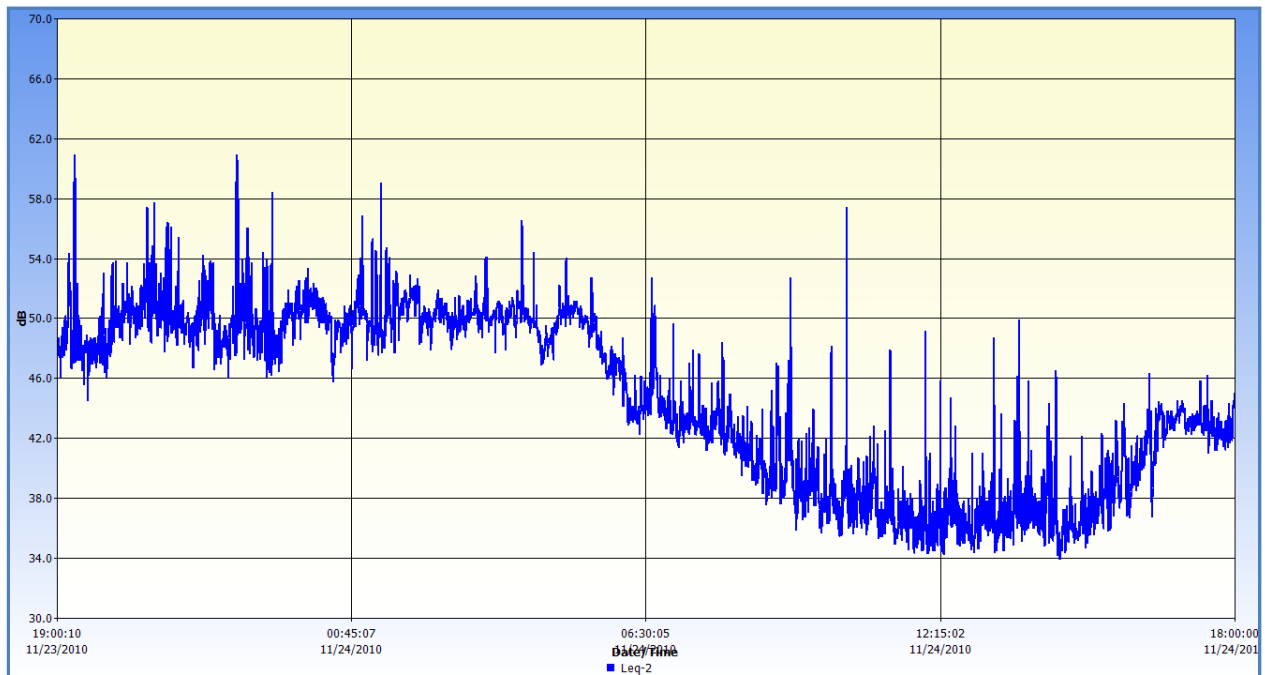


Figure 8 Noise fluctuation (Leq) over 24 hours at Station 3

3.3.1 Octave Band Analysis at Station 3

The noise at this station during the 24 hour period was in the low frequency band centred around the geometric mean frequency of 25 Hz. (octave frequency range is 22 - 28 Hz) (Figure 9). Although the noise was centred around the 25 Hz frequency, there was also noise emitted in the 63 Hz, 2.5 kHz, 5 kHz and 12.5 kHz frequencies.

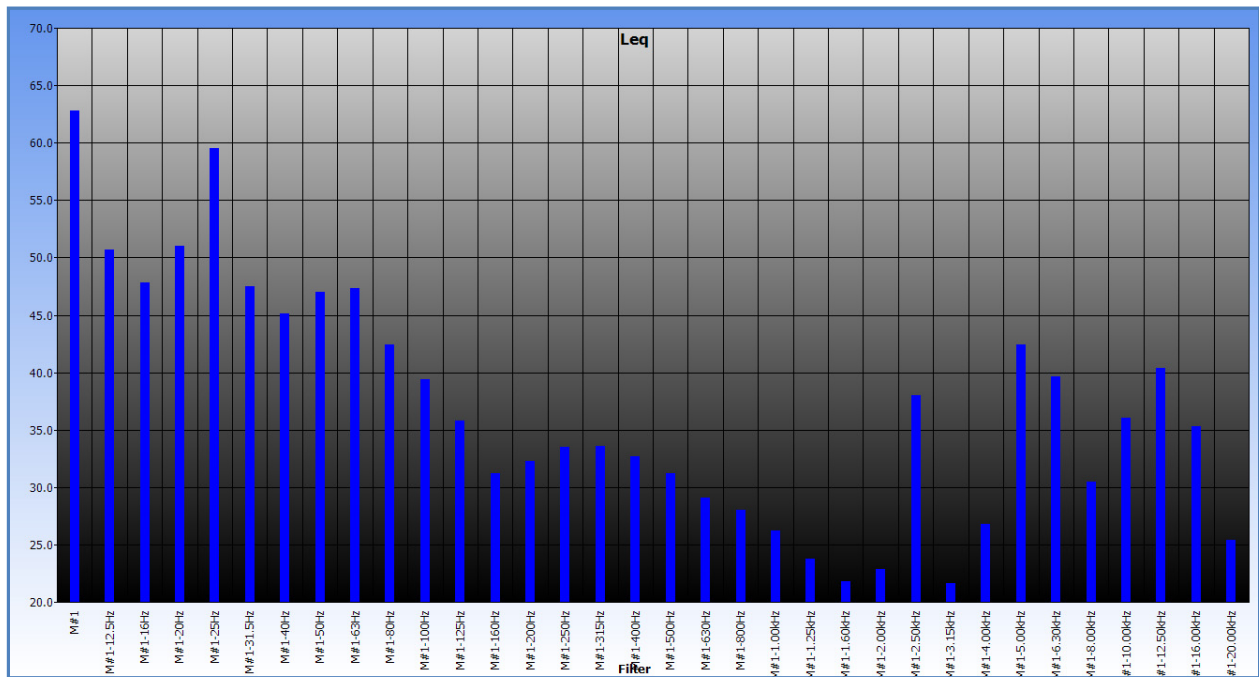


Figure 9 Octave band spectrum of noise at Station 3

3.3.2 L10 and L90

Figure 10 depicts the hourly L10 and L90 statistics for this station over the noise assessment period. The data shows no significant noise fluctuations (L10 – L90) ($\approx 91.3\%$ of the time) in the noise climate at this station. The largest fluctuations happened at 9 am and 3 pm.

The overall L10 and L90 at this station for the time assessed were 50.8 dBA and 36.4 dBA respectively.

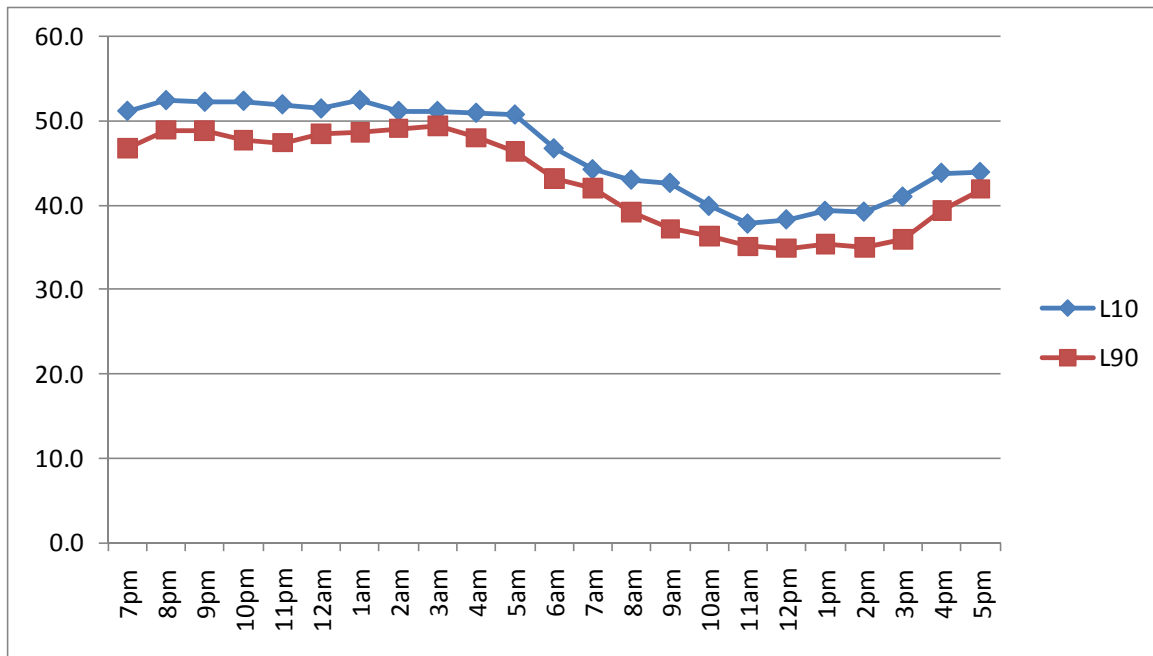


Figure 10 L10 and L90 for Station 3

3.4 STATION 4

During the 24-hour period, noise levels at this station ranged from a low (Lmin) of 33.0 dBA to a high (Lmax) of 76.1 dBA. Average noise level for this period was 47.0 L_{Aeq} (24h). The fluctuation in noise levels over the 24 hour period is depicted in Figure 11.

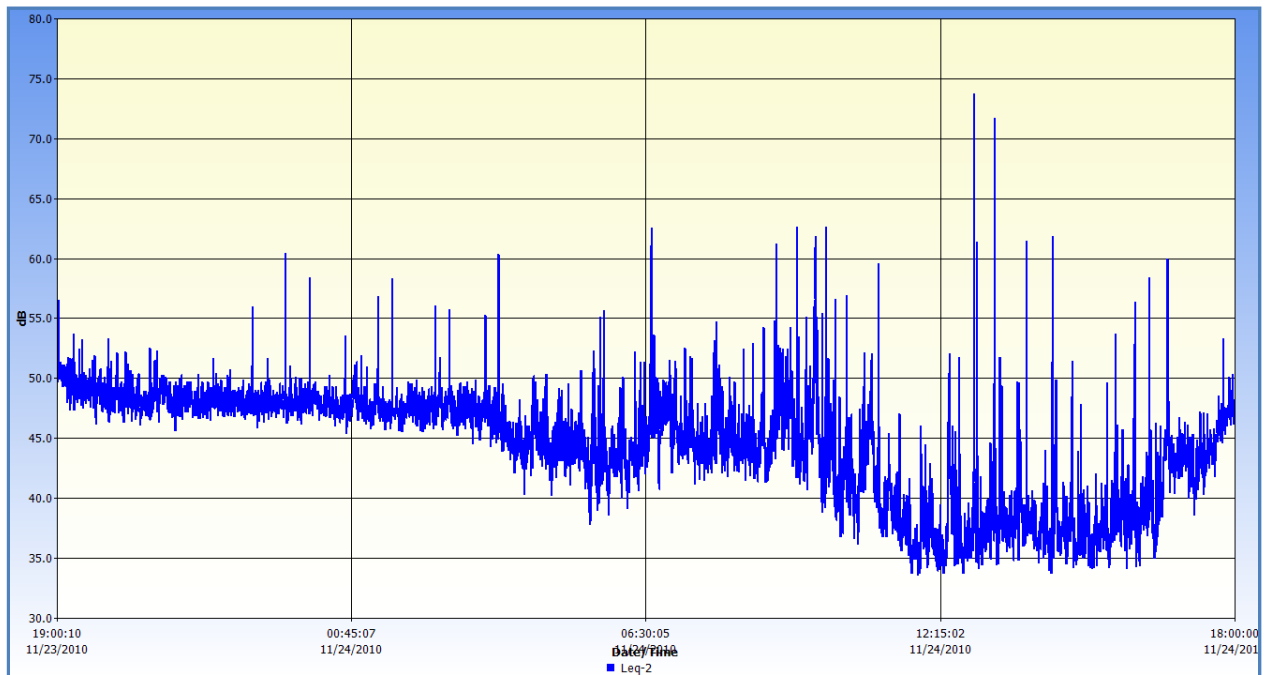


Figure 11 Noise fluctuation (Leq) over 24 hours at Station 4

3.4.1 Octave Band Analysis at Station 4

The noise at this station during the 24 hour period was in the low frequency band centred around the geometric mean frequency of 25 Hz. (octave frequency range is 22 - 28 Hz) (Figure 12). Although the noise was centred around the 12.5 Hz frequency, there was also noise emitted in the 50 Hz, 315 Hz, 6.3 kHz and 12.5 kHz frequencies.

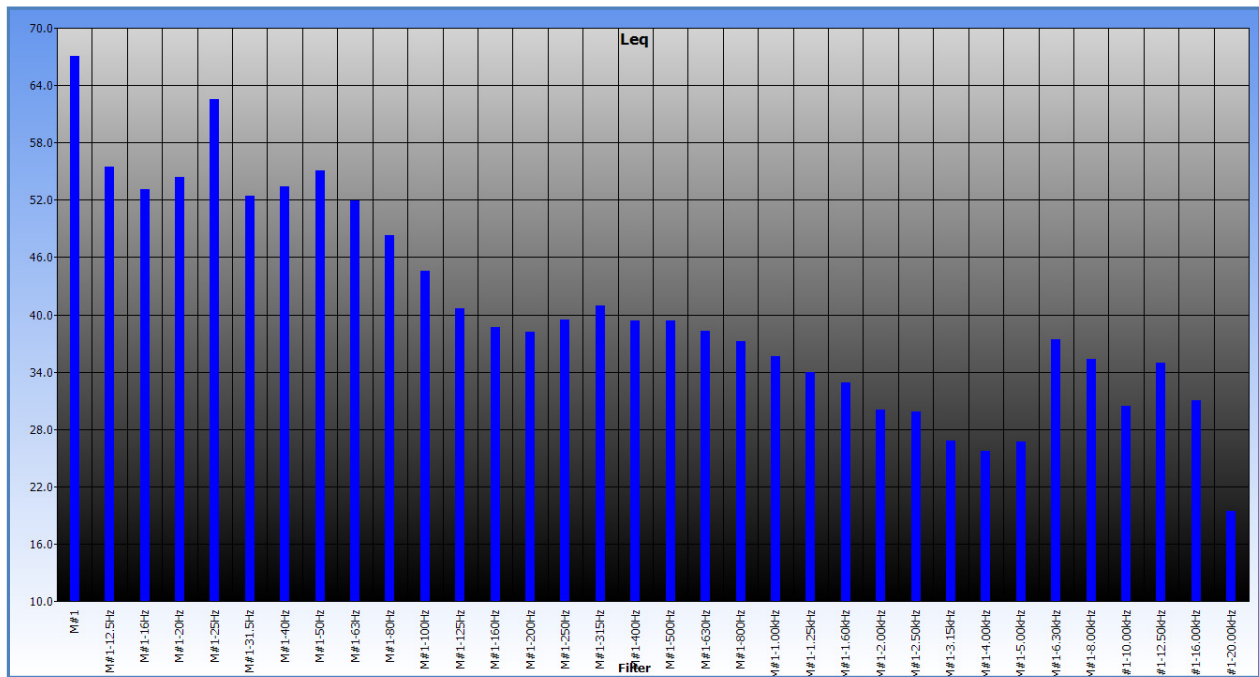


Figure 12 Octave band spectrum of noise at Station 4

3.4.2 L10 and L90

Figure 13 depicts the hourly L10 and L90 statistics for this station over the noise assessment period. The data shows moderate fluctuations (L10 – L90) (~52.2% of the time) in the noise climate at this station. The largest fluctuations happened at 9 am and 10 am.

The overall L10 and L90 at this station for the time assessed were 49.0 dBA and 37.0 dBA respectively.

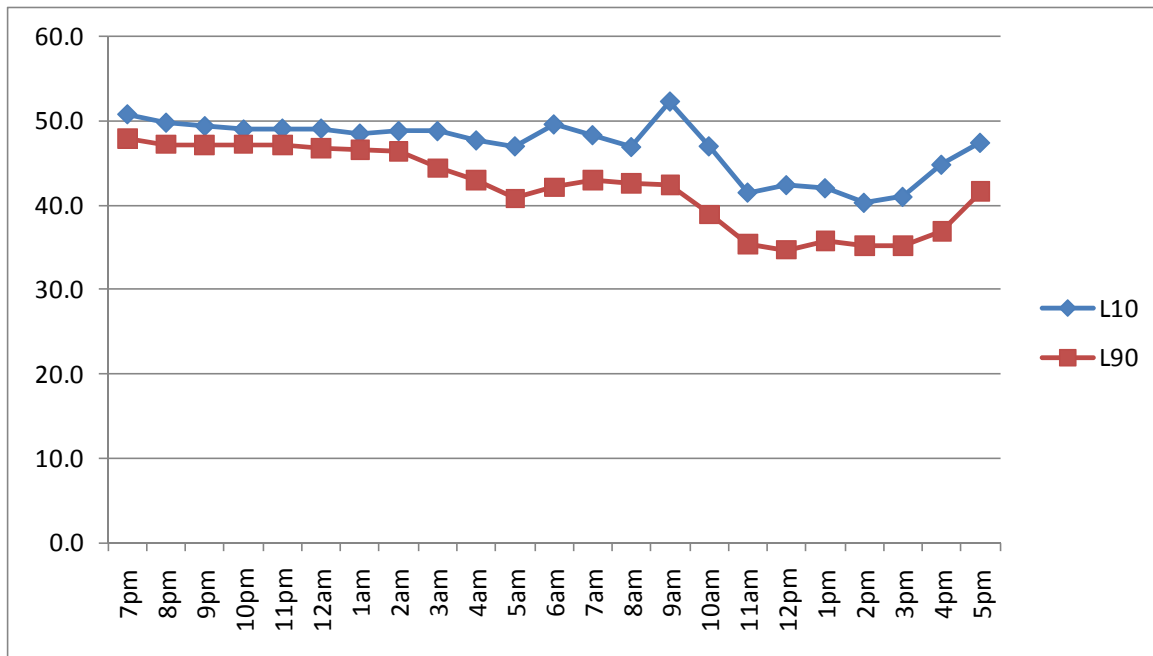


Figure 13 L10 and L90 for Station 4

3.5 STATION 5

During the 53-minute period, noise levels at this station ranged from a low (Lmin) of 55.8 dBA to a high (Lmax) of 74.4 dBA. Average noise level for this period was 57.9 L_{Aeq} (53 min). The fluctuation in noise levels over the fifty three minute period is depicted in Figure 14.

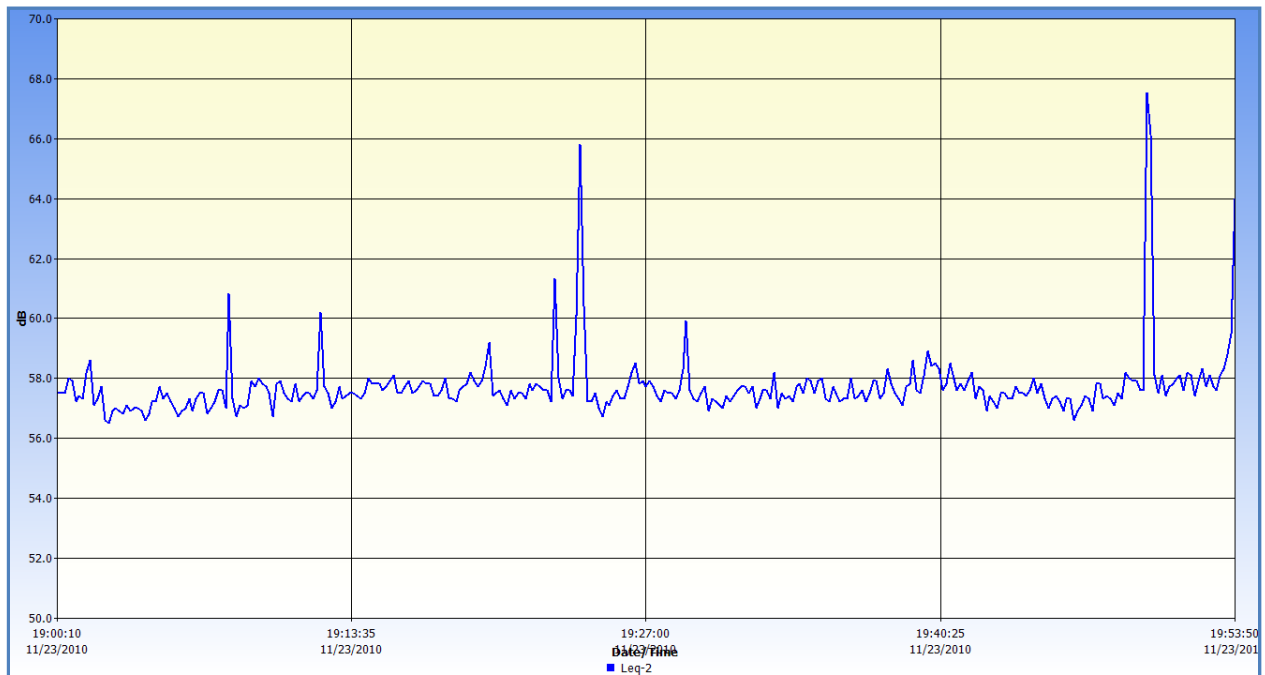


Figure 14 Noise fluctuation (Leq) over 53 minutes at Station 5

3.5.1 Octave Band Analysis at Station 5

The noise at this station during the 53 minute period was in the low frequency band centred around the geometric mean frequency of 40 Hz. (octave frequency range is 36 - 45 Hz) (Figure 15). Although the noise was centred around the 40 Hz frequency, there was also noise emitted in the 315 Hz, 2.5 kHz, 5 kHz and 12.5 kHz frequencies.

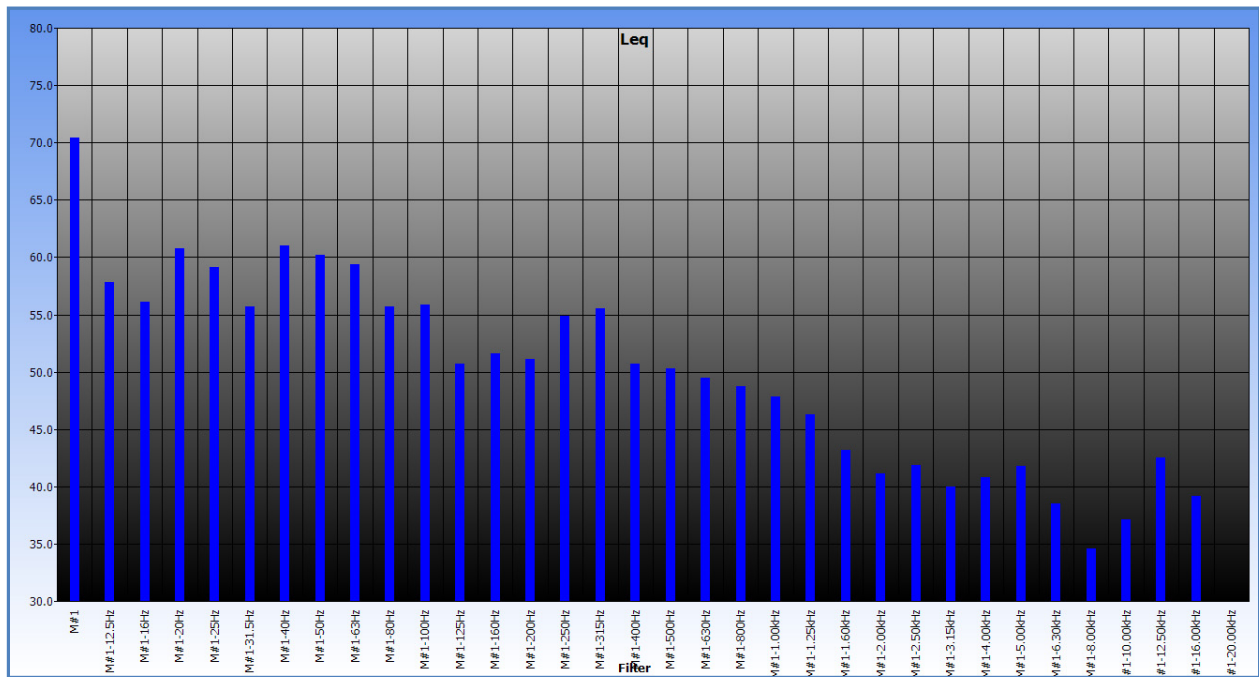


Figure 15 Octave band spectrum of noise at Station 5

3.5.2 L10 and L90

No calculation could be done due to insufficient data.

3.6 STATION 6

During the 24-hour period, noise levels at this station ranged from a low (Lmin) of 41.0 dBA to a high (Lmax) of 83.3 dBA. Average noise level for this period was 56.6 L_{Aeq} (24h). The fluctuation in noise levels over the 24 hour period is depicted in Figure 16.

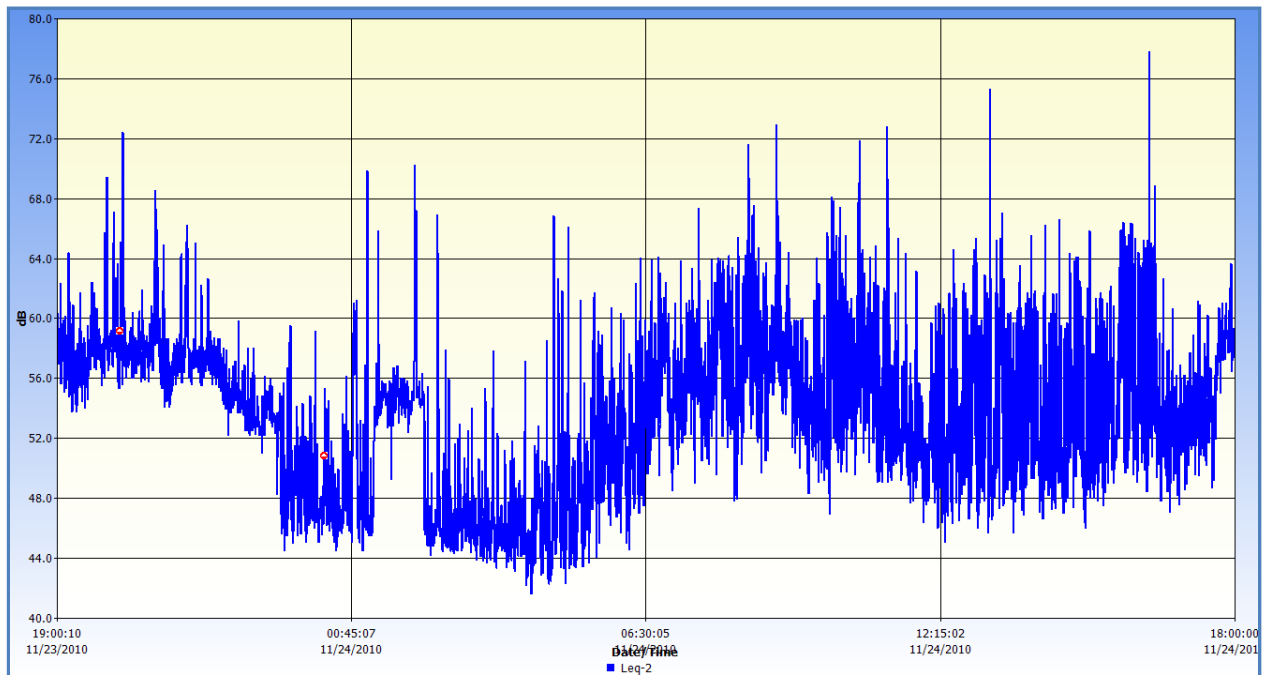


Figure 16 Noise fluctuation (Leq) over 24 hours at Station 6

3.6.1 Octave Band Analysis at Station 6

The noise at this station during the 24 hour period was in the low frequency band centred around the geometric mean frequency of 25 Hz. (octave frequency range is 22 - 28 Hz) (Figure 17). Although the noise was centred around the 25 Hz frequency, there was also noise emitted in the 50 Hz, 160Hz, 250 Hz 6.3 kHz and 12.5 kHz frequencies.

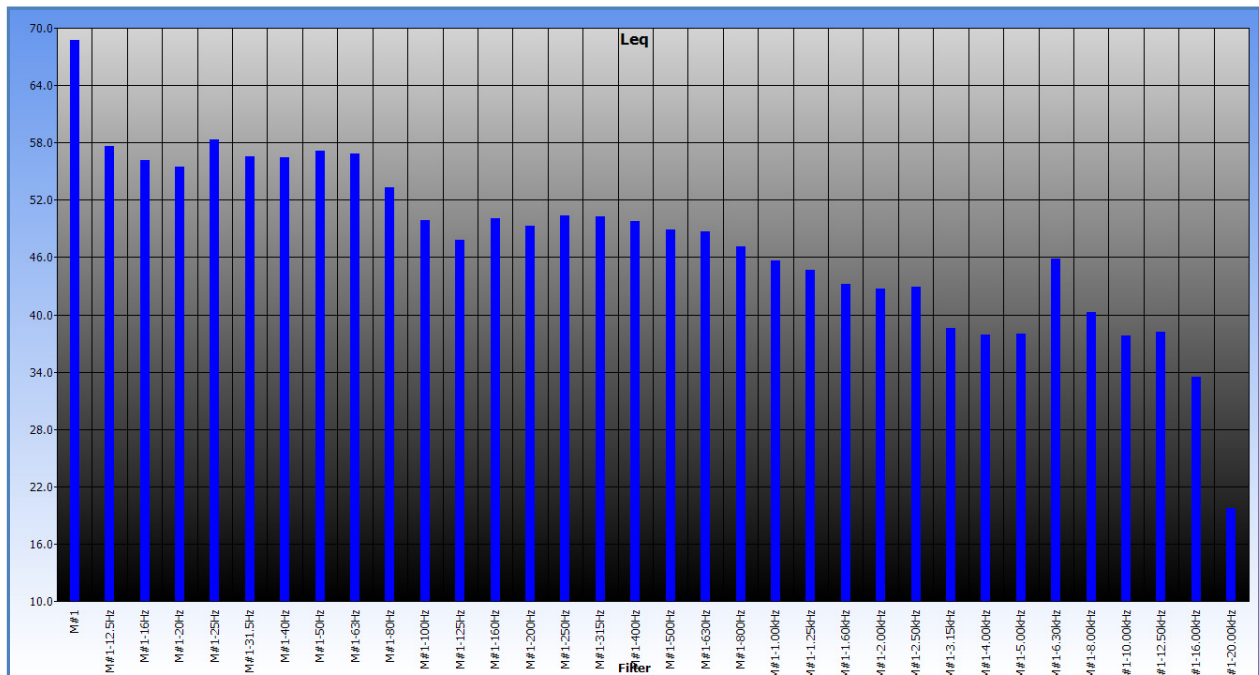


Figure 17 Octave band spectrum of noise at Station 6

3.6.2 L10 and L90

Figure 18 depicts the hourly L10 and L90 statistics for this station over the noise assessment period. The data shows moderate fluctuations (L10 – L90) (~82.6% of the time) in the noise climate at this station. The largest fluctuations happened between 12 - 1 pm and 3 - 4 pm.

The overall L10 and L90 at this station for the time assessed were 59.8 dBA and 46.4 dBA respectively.

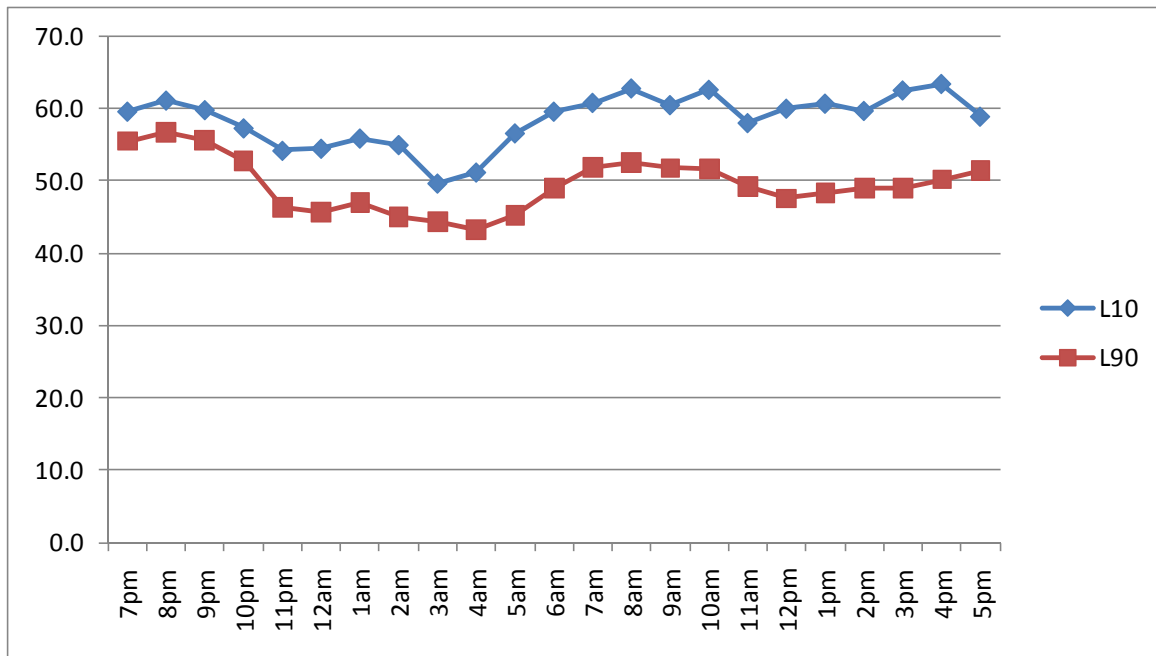


Figure 18 L10 and L90 for Station 6

4.0 COMPARISON WITH NEPA PROPOSED GUIDELINES

The National Environment and Planning Agency's has two guidelines as it relates to noise levels. The first is designated occupational and the second environmental noise. Stations 1 to 5 were within the occupational/industrial noise guideline. The environmental guideline is broken-down into zones and time periods (10 pm to 7 am and 7 am to 10 pm) (Table 2). Environmental noise guidelines include industrial, commercial and residential noise. For the purposes of this study, station 6 is considered residential.

During the 7 am to 10 pm time band, all stations except station 6 (58.0dBA) complied with the NEPA guidelines. During the 10 pm to 7 am time band, again station 6 (53.4dBA) was non-compliant with the NEPA guidelines.

Table 2 Comparison of average noise levels at the Stations with NEPA proposed noise guidelines.

| STN # | ZONE | ACTUAL AVG. LEVELS (dBA) (7 am. - 10 pm.) | NEPA DAY STD. (dBA) (7 am. - 10 pm.) | ACTUAL AVG. LEVELS (dBA) (10 pm. - 7 am.) | NEPA NIGHT STD. (dBA) (10 pm. - 7 am.) |
|-------|-------------|---|--------------------------------------|---|--|
| STN 1 | Industrial | 57.1 | 75 | 54.3 | 70 |
| STN 2 | Industrial | 46.6 | 75 | 45.2 | 70 |
| STN 3 | Industrial | 45.1 | 75 | 49.9 | 70 |
| STN 4 | Industrial | 46.8 | 75 | 47.4 | 70 |
| STN 5 | Industrial | - | 75 | - | 70 |
| STN 6 | Residential | 58.0 | 55 | 53.4 | 50 |

Numbers in red shows non- compliance to NEPA day and/or night standards

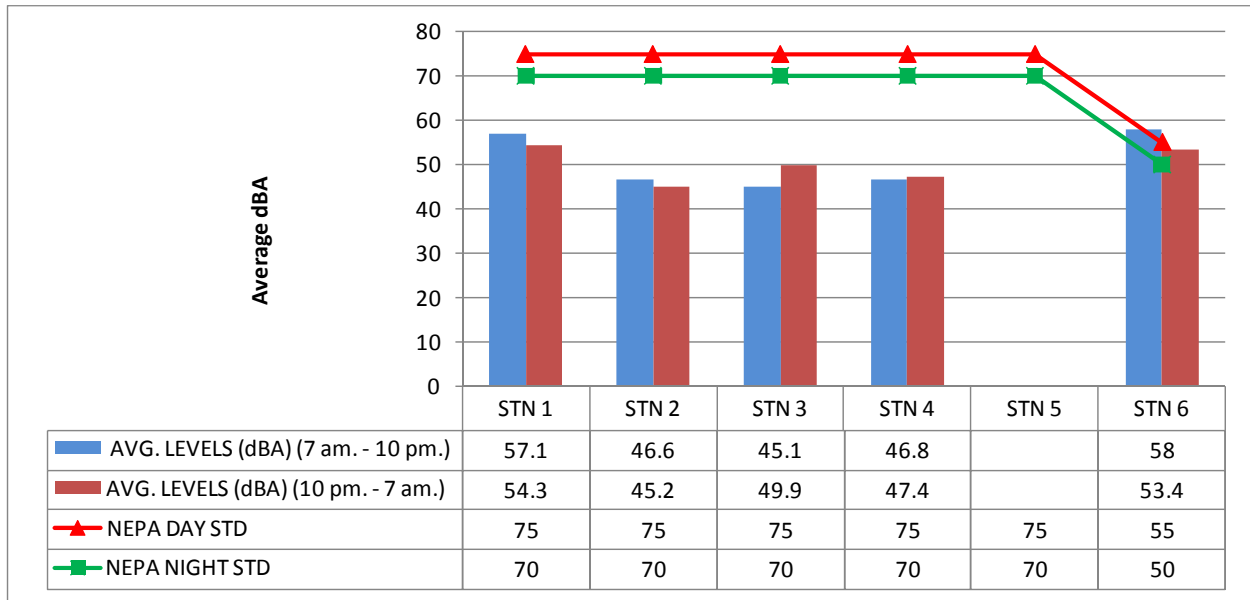


Figure 19 Graph depicting average dBA readings for day and night compared with NEPA guidelines

5.0 COMPARISON WITH WORLD BANK GUIDELINES

All the stations, except Station 6 (58.0 dBA – day time and 53.4 dBA night time) were compliant with World Bank guidelines (Table 3 and Figure 20).

Table 3 Comparison of Stations with World Bank Guidelines

| STN # | ZONE | ACTUAL AVG. LEVELS (dBA) (7 am. - 10 pm.) | WB DAY STD. (dBA) (7 am. - 10 pm.) | ACTUAL AVG. LEVELS (dBA) (10 pm. - 7 am.) | WB NIGHT STD. (dBA) (10 pm. - 7 am.) |
|-------|-------------|---|------------------------------------|---|--------------------------------------|
| STN 1 | Industrial | 57.1 | 70 | 54.3 | 70 |
| STN 2 | Industrial | 46.6 | 70 | 45.2 | 70 |
| STN 3 | Industrial | 45.1 | 70 | 49.9 | 70 |
| STN 4 | Industrial | 46.8 | 70 | 47.4 | 70 |
| STN 5 | Industrial | - | 70 | - | 70 |
| STN 6 | Residential | 58.0 | 55 | 53.4 | 45 |

Numbers in red shows non-compliance to World Bank day and/or night standards

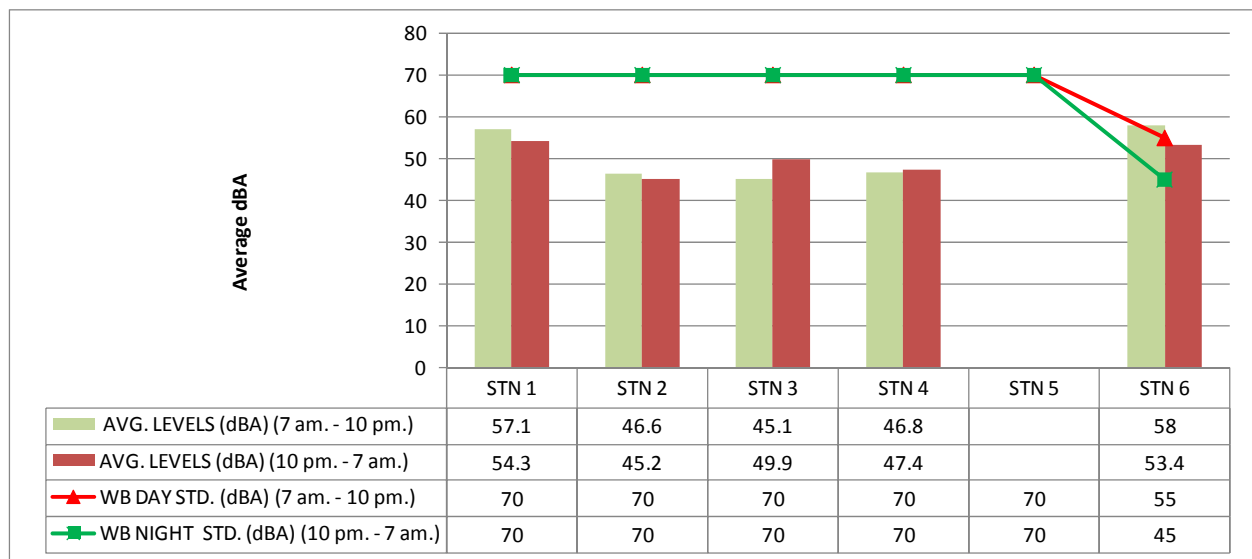


Figure 20 Graph depicting average dBA readings for day and night compared with World bank guidelines

6.0 CONCLUSIONS

- i) Average noise levels at all stations excepting for Station 6 (daytime-58 dBA, nighttime 53.4 dBA) complied with the NEPA proposed residential noise guidelines for daytime and nighttime (55 dBA and 50 dBA respectively).
- ii) Average noise levels at all stations excepting for Station 6 (daytime-58 dBA, nighttime 53.4 dBA) complied with the World Bank residential noise guidelines for daytime and nighttime (55 dBA and 45 dBA respectively).
- iii) All noise recorded in the area were in the low frequency range, mainly centred around the geometric mean frequency of 25 Hz (octave range 22-28 Hz). Station 1 was centred around the geometric mean frequency of 80Hz (octave range 71-90 Hz), and Station 5 was centred around the geometric mean frequency of 40Hz (octave range 36-45 Hz).
- iv) Stations 1, 2, 4 and 6 all showed mostly moderate fluctuations in the noise climate during the assessment period. Station 3 however, showed no significant fluctuations in the noise climate during the assessment period.

APPENDICES

Appendix 1 NOISE CALIBRATION CERTIFICATE



Certificate of Calibration

Certificate No:1076215QIH050059

Submitted By: C.L. ENVIRONMENTAL CO., LTD.
22 FORT GEORGE HEIGHTS
KINGSTON, 8

Serial Number: QIH050059

Date Received: 6/14/2010

Customer ID:

Date Issued: 6/21/2010

Model: QC-10 CALIBRATOR

Valid Until: 6/21/2011

Test Conditions:

Model Conditions:

Temperature: 18°C to 29°C

As Found: IN TOLERANCE

Humidity: 20% to 80%

As Left: IN TOLERANCE

Barometric Pressure: 890 mbar to 1050 mbar

SubAssemblies:

Description:

Serial Number:

Calibrated per Procedure: 56V981

Reference Standard(s):

| I.D. Number | Device | Last Calibration | Date Calibration Due |
|-------------|---------------------|------------------|----------------------|
| ET0000556 | B&K ENSEMBLE | 7/13/2009 | 7/13/2010 |
| T00230 | FLUKE 45 MULTIMETER | 2/3/2010 | 2/3/2012 |

Measurement Uncertainty:

+/- 1.1% ACOUSTIC (0.1DB) +/- 1.4% VAC +/- 0.012% HZ
Estimated at 95% Confidence Level (k=2)

Calibrated By:


PAUL WEGMANN Service Technician 6/21/2010

This report certifies that all calibration equipment used in the test is traceable to NIST, and applies only to the unit identified under equipment above. This report must not be reproduced except in its entirety without the written approval of Quest Technologies.

098-393 Rev. B

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