# 8-E.7: Noise Monitoring and Abatement Plan

***Updated Plan:*** *Plan submitted based on NIRB direction. Where historical information previously assessed and approved (as required) under the Type A Water Licence are in place for the Approved Project. This Approved Plan is submitted for ease of regulatory review. Updates were completed to account for Expansion Project activities.*

AGNICO EAGLE

MEADOWBANK GOLD PROJECT

WHALE TAIL PIT

# Noise Monitoring and Abatement Plan

In Accordance with

NIRB Project Certificates No. 004 and No.008

Prepared by: Agnico Eagle Mines Limited

Version 4_NIRB

December 2018

# EXECUTIVE SUMMARY

## GENERAL INFORMATION

This Noise Monitoring and Abatement Plan (NMAP) describe the operational procedures for noise abatement and monitoring at the Meadowbank Gold Project site and Whale Tail Pit Expansion Project, with respect to wildlife disturbance and potential offsite human receptors.

## ANNUAL REVIEW

The NMAP will be reviewed regularly and updated as necessary. Completion of the review of the NMAP will be documented through signatures of the personnel responsible for reviewing, updating and approving the NMAP.

## IMPLEMENTATION SCHEDULE

The proposed implementation schedule for this Plan is effective immediately (December 2018) subject to any modifications proposed by the NIRB as a result of the review and approval process.

## DISTRIBUTION LIST

Agnico Eagle Mines - Environmental Superintendent
Agnico Eagle Mines - Environmental Coordinator
Agnico Eagle Mines - Environmental General Supervisor

# DOCUMENT CONTROL

| Version | Date | Section | Page | Revision |
|---|---|---|---|---|
| 1 | 09/2009 | | | |
| 2 | 01/2014 | All | | See Record of Changes |
| 3 | 06/2018 | All | | Plan including Meadowbank and Whale Tail Pit |
| 4_NIRB | 12/2018 | All | | Noise Monitoring and Abatement Plan as Supporting Document submitted to the Nunavut Impact Review Board for review and approval as part of Whale Tail Pit – Expansion Project |

Version 4_NIRB

Prepared By: Golder Associates and Agnico Eagle Mines Ltd.

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## SECTION 1 • INTRODUCTION

The following document presents the Meadowbank and Whale Tail Pit - Expansion Project Noise Monitoring and Abatement Plan (the Plan) in support of Meadowbank Nunavut Impact Review Board (NIRB) Project Certificate No.004 Condition 62 and Whale Tail NIRB Project Certificate No.008 Conditions 4 and 5. This plan outlines Agnico Eagle's strategy for reducing noise disturbance on and near the Meadowbank and Whale Tail Pit - Expansion Project mine sites, with particular regard to wildlife and potential offsite human receptors.

Section 2 of this Plan describes target sound levels based on Environment and Climate Change Canada (2009) guidelines.

Section 3 describes the noise monitoring program that will be conducted to track typical noise levels in the local study area and to assist in the continual improvement of noise mitigation whenever possible.

Finally, Section 4 describes the onsite noise abatement plan for anticipated common noise sources and intense noise occurrences.

This plan has been updated for the Expansion Project in support of the Nunavut Impact Review Board (NIRB) review process.

# SECTION 2 • TARGET SOUND LEVELS

## 2.1 WILDLIFE

As no specific noise guidelines were found for the Meadowbank and Whale Tail Pit Expansion Project area, recommendations made by Environment and Climate Change Canada's "Environmental Code of Practice for Metal Mines" (2009) were adopted. This document states that:

> *"In residential areas adjacent to mine sites, the equilibrium sound pressure level ($L_{eq}$) from mining activities should not exceed 55 dBA during the day and 45 dBA at night. Ambient noise can also affect wildlife, so sites in remote locations should also work to meet these objectives for off-site ambient noise levels."*

Therefore, target offsite sound levels for the Meadowbank and Whale Tail Pit Expansion Project are:

Daytime (0700 – 2300 h) $L_{eq}$ = 55 dBA

Nighttime (2300 – 0700 h) $L_{eq}$ = 45 dBA

Results from noise monitoring stations located in proximity to the Meadowbank and Whale Tail Pit Expansion Project sites (including the noise monitoring stations located near the Whale Tail Pit Haul Road) are compared to these guidelines to assist in ongoing noise management (see Section 3).

To further ensure that mine site activities are not impacting wildlife more than predicted, Agnico Eagle maintains a Terrestrial Ecosystem Management Plan , as per Condition 54 of Meadowbank NIRB Project Certificate No.004 and Condition 28 of Whale Tail NIRB Project Certificate No.008.

## 2.2 OFFSITE HUMAN RECEPTORS

Although no offsite impacts to human receptors were identified in the FEIS or FEIS Addendum due to the remote location of the mine site, a Permissible Sound Level (PSL) may be developed in the event of construction of a dwelling in an impacted location. Based on the Alberta Energy and Utilities Board (EUB)'s "Directive 038: Noise Control" (2007) this value will be the existing noise level at the new dwelling, when constructed.

## SECTION 3 • NOISE MONITORING

### 3.1 OBJECTIVE

The objective of noise monitoring at the Meadowbank and Whale Tail Pit Expansion Project sites is to measure representative noise levels in proximity to the mines and roads, and to assist in the implementation of noise mitigation measures, wherever feasible (see Section 4).

### 3.2 MONITORING LOCATIONS

Agnico Eagle will continue to monitor noise levels around the Meadowbank mine site at five locations previously determined in consultation with Golder Associates Ltd. UTM coordinates for the base noise monitoring stations are provided in Table 1, and are shown in relation to the mine site features in Figure 1. All sites are located at a distance from noise sources to be representative of sound levels in locations where wildlife may be expected to occur, and where noise-related PPE is not required. These locations may be adjusted as mine site operations change, to target specific activities or receptors.

**Table 1 – Meadowbank Site Base Noise Monitoring Locations**

| Location Name | Easting | Northing |
|---|---|---|
| R1 | 636018 | 7217101 |
| R2 | 636795 | 7214435 |
| R3 | 641121 | 7214417 |
| R4 | 639441 | 7218750 |
| R5 | 633779 | 7214494 |

Agnico Eagle will also monitor noise levels around the Whale Tail Pit Expansion Project mine site and Whale Tail Pit Haul road at six locations. As per the Condition 5 of NIRB Project Certificate No.008, for noise monitoring, four (4) monitoring stations are located in the vicinity of the Whale Tail Pit Expansion Project and two (2) are along the Haul road. Two (2) of the chosen locations (R6 and R7) are the same receptor locations used for baseline monitoring (refer to Volume 4, Whale Tail FEIS, Agnico Eagle, 2016). The locations of the other four (4) noise monitoring stations (R8, R9, R10, and R11) have been updated in the current version of the Plan (i.e., Version 4) to maintain a reasonable separation from the proposed Whale Tail Expansion Project. A separation distance of 1,500 m has been selected in accordance with the EUB noise directive (EUB 2007). UTM coordinates for the Whale Tail Pit Expansion Project noise monitoring stations are provided in Table 2, and are shown in relation to the mine site features in Figure 2. These locations may be adjusted as mine site operations change, to target specific activities or receptors.

**Table 2 –Whale Tail Pit Expansion Project Noise Monitoring Locations**

| Location Name | Easting | Northing |
|---|---|---|
| R6 | 640708 | 7221964 |
| R7 | 620194 | 7239038 |
| R8[(a)] | 612414 | 7256890 |
| R9[(a)] | 603301 | 7256750 |
| R10[(a)] | 608154 | 7250529 |
| R11[(a)] | 606756 | 7258558 |

[(a)] The locations of these monitoring stations have been adjusted to maintain a reasonable separation (1,500 m) from the proposed Whale Tail Expansion Project.

### 3.2.1 R1

Location R1 is approximately 700 m south of the explosive storage area, 400 m north of the all-weather access road, and 3,500 m north of the Meadowbank camp. Third Portage Lake is nearby to the south, and surrounding terrain is rocky tundra with some vegetation.

### 3.2.2 R2

Location R2 is approximately 600 m southwest of the airstrip, and 1,600 m northwest of the Meadowbank camp. Third Portage Lake is to the west and southwest and surrounding terrain is vegetated tundra with rocky outcrops.

### 3.2.3 R3

Location R3 is approximately 1,800 m east of the East Dike, and 3000 m east of the Meadowbank camp. Second Portage Lake is to the west and east, and surrounding terrain is vegetated tundra with rocky outcrops.

### 3.2.4 R4

Location R4 is approximately 1,100 m southwest of Phaser Pit, and 5,350 m north of the Meadowbank camp. Turn Lake is to the west, and surrounding terrain is vegetated tundra with rocky outcrops.

### 3.2.5 R5

Location R5 is in the exploration camp area, near the all-weather access road, approximately 3,500 m west of the airstrip and 4,500 m west of the Meadowbank camp. Third Portage Lake is immediately to the east, and surrounding terrain away from the shoreline is vegetated tundra with rocky outcrops. This location is situated on a known caribou migration route.

### 3.2.6 R6

Location R6 is approximately 1,500 m east from the Whale Tail Pit Haul road and approximately 1,500 m north from the centre of the Vault Pit. The waste rock storage area of the Vault Pit is located approximately 750 m south from the monitoring site.

### 3.2.7 R7

Location R7 is approximately 1,500 m east from the Whale Tail Pit Haul Road.

### 3.2.8 R8

Location R8 is approximately 1,500 m east from the Whale Tail Pit Expansion Project.

### 3.2.9 R9

Location R9 is approximately 1,500 m west from the Whale Tail Pit Expansion Project.

### 3.2.10 R10

Location R10 is approximately 1,500 m south from the Whale Tail Pit Expansion Project.

### 3.2.11 R11

Location R11 is approximately 1,500 m north from the Whale Tail Pit Expansion Project.

634000 636000 638000 640000 642000 644000

7218000 7216000 7214000 7212000

N

R1 R2 R3 R4 R5

NP 2

Dodleg North

Dodleg Pond

North Basin

Second Partage Lake

Third Partage Lake
Lake

150m 200m

## Legend

- NOISE MONITORING POINT
- ROADS

0 0.125 0.25 0.5 0.75 1 Kilometers

SNC·LAVALIN

AGNICO EAGLE MINE LIMITED
MEADOWBANK DIVISION

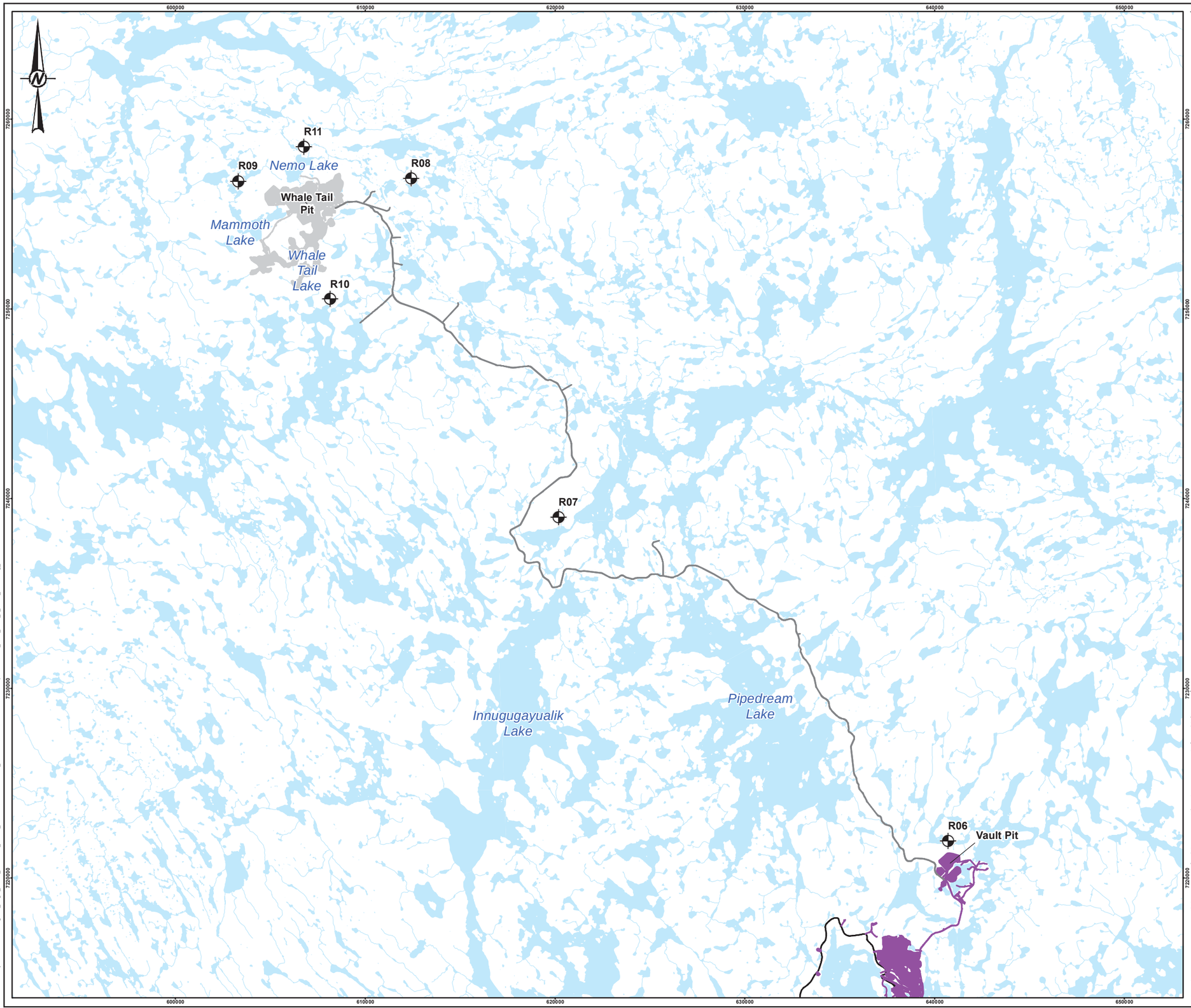
**WORK DOCUMENT**

Project : 655183

# Meadowbank Noise Monitoring Stations

Coordinate system UTM, zone 14, NAD83

**June 11, 2018** | **Fig.1**




**LEGEND**

- NOISE MONITORING LOCATION
- INFRASTRUCTURE
- HAUL ROAD
- MEADOWBANK OPERATION AND INFRASTRUCTURE
- WATERCOURSE
- WATERBODY

0 4,000 8,000

1:200,000 METRES

**REFERENCE(S)**

1. INFRASTRUCTURE OBTAINED FROM AGNICO EAGLE MINES LIMITED, DRAWING AMQ 2025Q4V5.DWG.
2. WATERCOURSE AND WATERBODY DATA OBTAINED FROM NATURAL RESOURCES CANADA. DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

CLIENT

AGNICO EAGLE MINES LIMITED: MEADOWBANK DIVISION

PROJECT

WHALE TAIL PIT - EXPANSION PROJECT

TITLE

**WHALE TAIL PIT EXPANSION PROJECT**
**NOISE MONITORING STATIONS**

CONSULTANT

GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2018-12-17 |
| DESIGNED | VY |
| PREPARED | CDB/CN |
| REVIEWED | JR |
| APPROVED | DF |

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 1896037 | 4200/4205 | 0 | 2 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

0 25mm

PATH: Y:\Aumaty\CAD-GIS\Client\Agnico_Eagle_Mines_Ltd\Whale_Tail\9.PROJECTS\1896037\02_PRODUCTION\4200\MXD\4205\Report\1896037_4200_4205_2_Noise_Monitoring_Stations.mxd PRINTED ON: 2018-12-17 AT: 11:11:49 AM

### 3.3 MONITORING FREQUENCY

Agnico Eagle field staff will aim to conduct a minimum of two noise surveys per year at each of the locations described in Section 3.2. Each survey will be for a 2-4 days period to ensure significant data is collected. These surveys provide data on average noise levels during a typical day, as well as variability of noise levels within the day.

### 3.4 SOUND LEVEL METER

A Bruel and Kjaer Model 2250 integrating sound level meter will be used to conduct the noise surveys at the locations described in Section 3.2. The noise level logging rate will be set at one-minute intervals, and sound will be recorded in 10 minute intervals.

The parameters logged each minute will be:

- Integrated average sound level, in dBA – $L_{eq}$
- Absolute maximum sound level, in dBA – $L_{max}$
- Absolute minimum sound level, in dBA – $L_{min}$

### 3.5 WEATHER DATA

Weather data for the noise monitoring periods is collected using onsite weather stations. Hourly data for wind, temperature and relative humidity is available from this station. This data is used to screen out sound levels collected under inappropriate conditions (see Section 3.7).

### 3.6 FIELD NOTES

A pocket weather meter (Kestrel 3000) will be used by field staff to record wind speed, direction and temperature at the beginning and end of each monitoring period. Other records include precipitation, cloud cover and observed noises during instrument set-up and take-down. See Appendix A for an example field monitoring sheet.

### 3.7 QUALITY CONTROL

Calibration of the sound level instrument will be performed before and after each monitoring period using a Bruel and Kjaer Type 4231 Calibrator, to ensure variance is within 0.5 dB. Calibration results are recorded in field notes. Estimated uncertainty of the calibrator is ± 0.12 dB at a 99% confidence level. Professional calibration of the instrument will be performed as described in Section 5.

### 3.8 DATA ANALYSIS

Since noise levels vary over time, the monitoring instrument used measures near-continuously and reports a single-number value for each minute, representing the “equivalent sound level” ($L_{eq}$). This value is the average sound level occurring over the specified time period (i.e.one minute). Alternatively, it is the sound level that would produce the same total amount of acoustical energy in the specified time period as the measured sound levels did.

Data downloaded from the instrument will be filtered to remove measurements collected outside of acceptable weather conditions (wind speed > 4.17 m/s; relative humidity > 90%). All data points associated with the first and last 30 min of measurement will be filtered out to remove noise from technicians, and more than 30 min of data will contribute to hourly averages.

One-minute $L_{eq}$ values produced by the instrument will be used to calculate hourly, day-time (7am-11pm), night-time (11pm-7am) and 24 hr $L_{eq}$ values. These time periods are based on Health Canada recommendations, as described in Golder (2012). $L_{eq}$ values for each time period are calculated as the logarithmic average of filtered one-minute $L_{eq}$ values.

### 3.9 REPORT

Results of the noise monitoring program will be compiled annually and reported to NIRB and Environment and Climate Change Canada. Reports will include, for each station:

- Visual display of one-minute $L_{eq}$, one-minute maximum and one-minute minimum values;
- Hourly, daytime, nighttime and 24 hr $L_{eq}$ values, including number of hours of valid data contributing to each;
- Weather data for each monitoring period (temperature, wind speed and direction);
- Audible noises noted on field logs and in sound files, especially those corresponding with intense noise occurrences (see Section 4.3);
- Comparison of daytime and nighttime $L_{eq}$ values to target sound levels, for applicable stations (those located at the site perimeter);
- A historical comparison of daytime, nighttime and 24-hr $L_{eq}$ values, and comparison to predicted noise levels for the Projects;
- Recommendations for additional monitoring or for implementation of additional abatement measures, if possible, when sources of intense noise occurrence are confirmed.

# SECTION 4 • NOISE ABATEMENT

## 4.1 GENERAL PRACTICES

The Meadowbank and Whale Tail Pit Expansion Project mine sites infrastructure are laid out to concentrate all activities within a small footprint (see Figures 1 and 2). As a result, the common noise sources at site are in close proximity to one another and for the most part are contained within separate buildings (i.e. facilities such as the crusher, SAG mill are indoors to reduce noise intensity). Personnel office spaces and accommodations are separate from these operational buildings. The Meadowbank and Whale Tail Pit Expansion Project site infrastructure are oriented to reduce intense noise occurrences that may impact wildlife or personnel. These attenuation measures taken during the design and construction of the infrastructure are an important component of noise abatement on the mine sites.

In general, all departments will strive to ensure that equipment manufacturers have incorporated noise attenuation into their design as much as possible, will maintain equipment in good working condition, and will position stationary equipment away from potential receptors of concern or in enclosed areas.

## 4.2 DAILY NOISE OCCURRENCES

Common noise sources that are daily occurrences may include road traffic, air traffic, impact equipment, stationary equipment (such as generators, compressors or pumps), construction activities, blasting, material handling (i.e. crushers, cranes), earth movers (i.e. truck loaders and dozers) and the Meadowbank primary plant facilities (i.e. SAG mill, ball mill and power plant).

Table 3 describes the project-related noise sources that have been identified as well as proposed mitigation/management measures to be implemented whenever possible during operation of the facility.

**Table 3 - Standard mitigation measures for daily noise occurrences.**

| Noise Source | Noise Mitigation Measures |
|---|---|
| Whale Tail Haul Road Construction and Widening | • Operate construction equipment within specification and capacity (i.e., don't overload machines)<br>• Adequate equipment maintenance<br>• Avoid operating numerous pneumatic tools at the same time, and spread operation throughout working periods<br>• Avoid prolonged idling<br>• If blasting is required, preference for daytime blasting |
| Road traffic (mine site, AWAR) and Haul Roads operation | • During maintenance, check that noise abatement devices are in good order (e.g., brakes, exhaust mufflers, engine hoods)<br>• Enforce speed limits<br>• Use shallow slopes for haul road |

| Noise Source | Noise Mitigation Measures |
|---|---|
| | • Educate truck drivers about the characteristics of diesel engines (i.e., that the flat torque characteristic allows ascending an incline in a higher gear, which is a less noisy operation)<br>• Keep road surfaces in good repair to reduce tire noise<br>• Avoid prolonged idling<br>• Avoid trucking operation during night time on access road, when possible |
| Air traffic (Meadowbank) | • Avoid low altitude flights (not lower than 610 m in sensitive bird/wildlife areas), except on take-off and landing<br>• Restrict air traffic to daytime hours except for emergencies |
| Impact equipment (pile drivers, jack hammers, drills, pneumatic tools) | • Avoid operating numerous pneumatic tools at the same time, and spread operation throughout working periods |
| Stationary equipment (compressors, generators, pumps) | • Keep equipment in good condition |
| Blasting | • Use delays, both surface and down hole<br>• Preference for daytime blasting<br>• Blasting in depressed pits (normal production practice) |
| Outdoor material handling equipment (crushers, concrete mixers, cranes) | • Place crushers in sheltered/enclosed locations if possible<br>• Maintain equipment in good working condition<br>• Turn equipment off when not in use if practicable |
| Earth moving equipment (trucks, loaders, dozers, scrapers) | • Aim to restrict equipment age so only newer, more efficient machinery will operate onsite<br>• Operate equipment within specification and capacity (i.e., don't overload machines)<br>• Use noise abatement accessories such as sound hood and mufflers |
| Primary plant facilities (gyratory primary crusher, SAG mill, ball mill, power plant) | • Provide building with walls absorbing noise<br>• Maintain equipment on a regular basis, replace worn parts, lubricate as required<br>• Provide diesel plant units with efficient intakes and exhaust silencers<br>• Use conveyor system with low noise output, paying particular attention to rollers<br>• Enclose conveyors where necessary |
| Utilities and services | • Ensure that a rotating biological contactor treatment system operates quietly<br>• Dump solid waste behind barriers |

## 4.3 INTENSE NOISE OCCURRENCES

### 4.3.1 Strategy

It has been found that people (and therefore, potentially, wildlife) are more tolerant of louder continuous background noise than a quieter baseline punctuated by high-level peaks. Therefore, the intense noise abatement strategy acknowledges the common continuous noise sources, and aims to reduce the occurrence of intense noise peaks. For the purposes of this Plan, intense noise occurrences are considered to be those that exceed the target sound levels described in Section 2. Examples of these may be low flying air traffic, exceedingly loud blasting or nearby impact equipment. Since noise monitoring stations may be located away from the site perimeter, the target sound levels are only used as a conservative benchmark to filter audio files for closer analysis and adaptive noise management.

### 4.3.2 Identification

Through the annual monitoring program, 24-h sound profiles for each monitoring station will be developed, and the daytime equivalent sound level ($L_{eq}$) identified (see Section 3.7). Recorded sound files will then be reviewed in conjunction with field notes to attempt to determine the sources of intense noises (> target sound levels).

### 4.3.3 Abatement

When sources of intense noises are confirmed, the Environment Department staff will work with the responsible party to determine whether further abatement of the noise is possible. At a minimum, this will include ensuring the previously identified mitigation measures (Table 3) are being applied. If all abatement practices are in use and the source continues to contribute to intense noise occurrences in subsequent monitoring events, the implementation of additional appropriate measures will be investigated. This method of intense noise identification means that there will be a continual effort to reduce the sounds contributing to the loudest, most disruptive noise peaks onsite, even as site operations evolve and average noise levels change.

## SECTION 5 • MANAGEMENT AND OPERATION

The following presents the plan's management responsibility, and operational procedures for the Bruel and Kjaer Model 2250 integrating sound level meter.

### 5.1 MANAGEMENT RESPONSIBILITY

Operation and monitoring of the noise stations will come under the responsibility of the Environment Superintendent. Designation of training requirements is the responsibility of the Environment Department.

### 5.2 EQUIPMENT OPERATION

The Environment Department will be responsible for the operation of equipment and collection of samples by appropriately trained personnel consistent with detailed written operating instructions (SOP – Appendix B) from qualified personnel. The SOP will be kept up-to-date and any changes will be communicated to relevant personnel.

### 5.3 EQUIPMENT MAINTENANCE

As recommended by the manufacturer and to make sure results are in compliance with good practices, the meter will be factory calibrated and certified per the schedule outlined below.

| Calibration | Interval |
|---|---|
| Microphone | 2 years |
| Meter | 2 years |
| Calibrator | 1 year |

## SECTION 6 • PLAN REVIEW

The Noise Monitoring and Abatement Plan will be reviewed regularly by the Environmental Superintendent and be updated if any changes to the equipment or the program occur.

## SECTION 7 • REFERENCES

Agnico Eagle (2018). Terrestrial Ecosystem Management Plan, Meadowbank Division. June 2018.

Agnico Eagle (2016). Final Environment Impact Statement (FEIS) Volumes 1 to 8, Whale Tail Pit Project, Meadowbank Division. Volume 4 – Atmospheric Environment

AEM (2009). Noise Management and Abatement Plan. Meadowbank Gold Project. Version 1. September, 2009

Alberta Energy and Utilities Board (2007). Directive 038 - Noise Control.

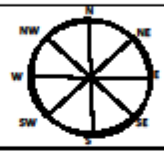
Environment Canada (2009). Environmental Code of Practice for Metal Mines. 1/MM/17 Mining Section, Mining and Processing Division, Public and Resources Sectors Directorate, Environmental Stewardship Branch.

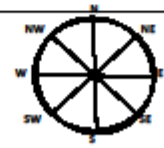
Health Canada (2005) Noise Impact Assessment Orientation Document for Projects Triggering CEAA. Prepared by the Healthy Environments and Consumer Safety Branch. Health Canada, May 2005.

Golder Associates (Golder), 2012. 2011 Noise Monitoring, Meadowbank Division, Nunavut. Prepared for Agnico-Eagle Mines Ltd. February, 2012.

## Appendix A

## Example of noise monitoring field sheet

| MONITORING STARTS | | | |
|---|---|---|---|
| Operator: | | | |
| Location: | | | |
| Noise Meter Start Time: | | | |
| Date: | | | |
| Calibration complete ?: | | | |
| Sensitivity | | | |
| Derviation | | | |
| Time of Calibration: | | | |
| Battery Power Check: | Good | | Poor |
| Photographs of Setup (Y/N) | | | |
| Photographs of Surrounding (Y/N) | | | |
| Check available disk memory (Y/N) | | | |
| Cloud cover: | cloudy | partly cloudy | sunny |
| Height of cloud (feet): | 0-10,000 | 10,000-25,000 | 25,000 + |
| Air Temperature (C): | | | |
| Wind Speed (km/hr): | | | |
| Wind Direction:<br>North wind (wind blows from North) |  | | |
| Barometric Pressure (kPa): | | | |
| Relative Humidity (%) | | | |
| Precipitation: | none | drizzle | rain |
| GENERAL SITE DESCRIPTION | | | |
| GPS Location | Latitude | Longitude | Altitude |
| | | | |
| Type of Ground Surface: | | | |
| Acoustic Environment: | | | |
| Traffic | | | |
| Human activities | | | |
| Animal | | | |
| Other noise sources | | | |

| MONITORING ENDS | | | |
|---|---|---|---|
| Operator: | | | |
| Record Data File Name: | | | |
| Total Monitoring Period | | | |
| Noise Meter End Time: | | | |
| Date: | | | |
| Calibration complete ?: | | | |
| Sensitivity | | | |
| Derviation | | | |
| Time of Calibration: | | | |
| Check file size (GB) | | | |
| Battery Power Check: | Good | | Poor |
| Cloud cover: | cloudy | partly cloudy | sunny |
| Height of cloud (feet): | 0-10,000 | 10,000-25,000 | 25,000 + |
| Air Temperature (C): | | | |
| Wind Speed (km/hr): | | | |
| Wind Direction:<br>North wind (wind blows from North) |  | | |
| Barometric Pressure (kPa): | | | |
| Relative Humidity (%) | | | |
| Precipitation: | none | drizzle | rain |
| Depature Time: | | | |

## Appendix B

## Environmental Noise Monitoring Guide - Bruel and Kjaer 2250 Sound Level Meter

**GOLDER ASSOCIATES**

# ENVIRONMENTAL NOISE MONITORING GUIDE


Doc. No. 747 Ver.0

September 2008

08-1428-0007/4000/4100

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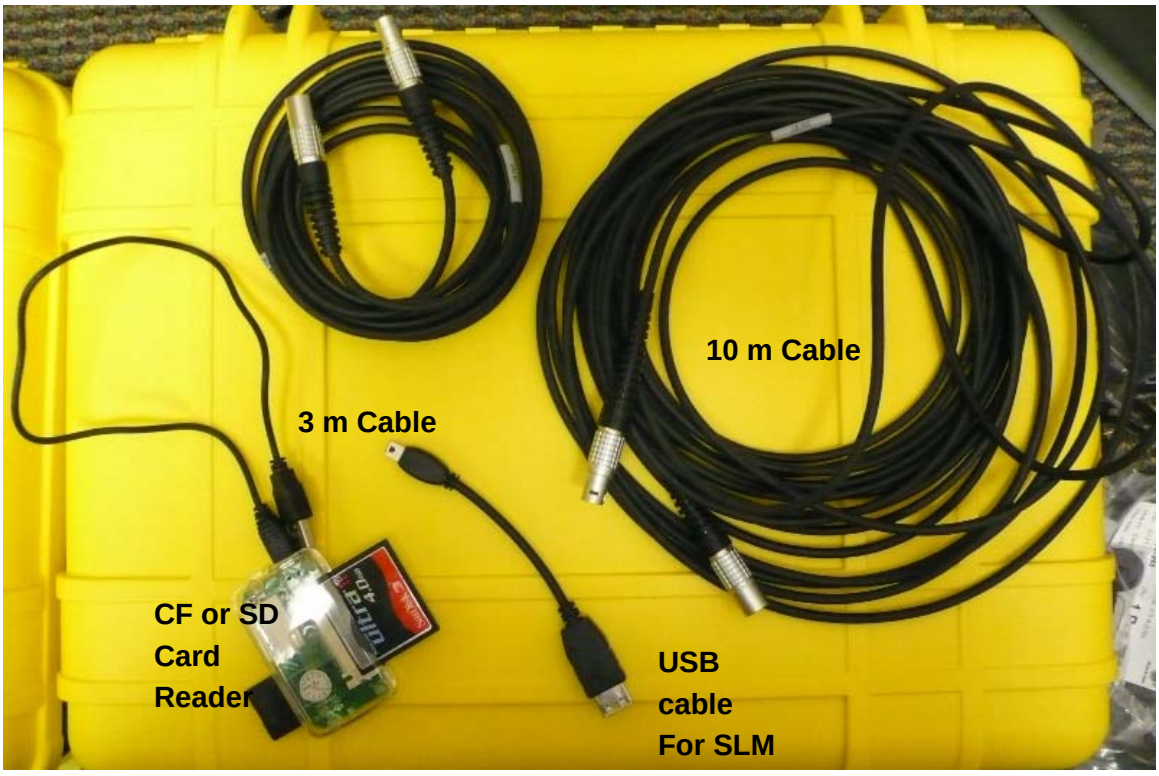
## 1.0 LONG-TERM MONITORING CONFIGURATION

The Bruel and Kjaer 2250 sound level meter (2250 SLM) can be configured for short or long term noise monitoring. The photo below shows the long-term monitoring setup including the weather protective case. In long-term monitoring, the following components are required:

- 2250 SLM;
- Microphone and Preamp Assembly;
- Outdoor Microphone Kit;
- Microphone Extension Cable;
- Tripod;
- External 12 Volt DC Power Supply;
- Power Supply Cable Connector;
- External Memory Card (CF-Card or SD-Card);
- Support Pegs; and
- Electrical Tape.

### 1.1 Storage Case Setup

The monitoring components and setup for the equipment storage case are shown below.

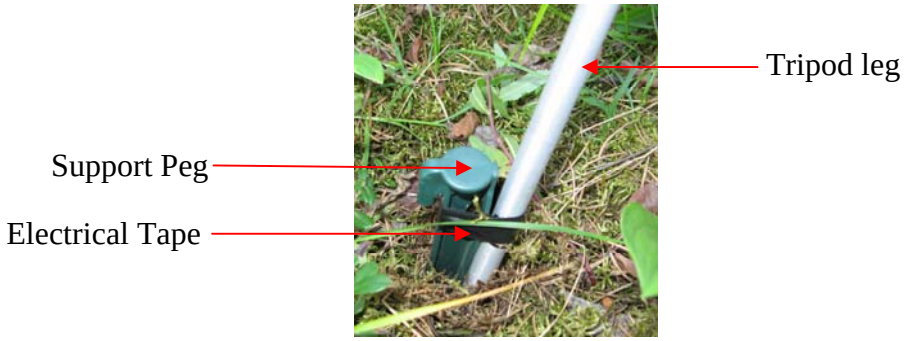
### 1.2 Outdoor Microphone Assembly

The procedure for assembling the outdoor microphone is summarized below:

## 1.3 Hardware Setup Procedure

### 1.3.1 Tripod

Extend the tripod to its maximum extension. Secure a support peg to end of each tripod leg, making sure that the pegs are parallel to the leg. Using electrical tape (note electrical tape is ideal as it is durable and can be easily removed) to secure the tripod legs to the support pegs such that little to no swaying or tipping is possible. Insert the support pegs into the ground far enough to provide ample support of the legs of the tripod.




### 1.3.2 Outdoor Microphone Kit

Remove the outdoor microphone kit windscreen and extension cable and attach it to the top of the extension pole. Run the microphone extension cable down one of the tripod legs securing it with electrical tape approximately every 2 feet along the leg as shown below.

### 1.3.3 Extension Cable Connection

Connect the microphone extension cable to the input of the B&K 2250 Analyzer making sure that the dot on the extension cable is lined up with the dot on the input of the Analyzer (see left figure below).

Note, when dismantling the meter it may be difficult to remove the microphone extension cable from the B&K 2250 Analyzer. If difficulties do arise, place a cloth over the sleeve and use pliers to gently grip and pull back the sleeve to release the connection as shown below.

Sleeve

Place cloth over sleeve.

Use pliers to gently pull back sleeve.

### 1.3.4 Long Term Power Supply (12V DC)

Connect the power supply cable from the 12V Panasonic battery to the external power supply located at the base of 2250 SLM. There are two indicators to confirm that 12V DC power supply is connected successfully to the 2250 SLM:

- The green LED which is located at the bottom of the B&K 2250 Analyzer should be on; and

Check 2250 Analyzer LED for power.

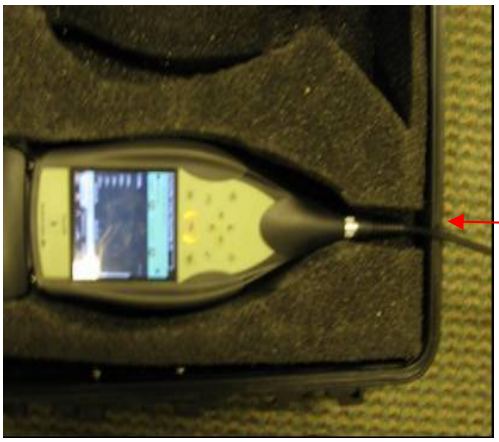
- The battery symbol on the B&K 2250 Analyzer screen display changes from a battery to a power plug symbol - as shown in the figure below.


External power symbol indicating that external power is connected.

A flashing green LED light indicates the internal battery of the Sound Level Meter is fully charged (100%).

### 1.3.5 Extension Cable Arrangement

There are two data cable available (3 m and 10 m). Use the 3 m when connect to the handheld microphone pre-amp and use the 10 m extension cable when using the outdoor microphone kit. The microphone extension cable must extend across the notched portion of the sound level meter case as shown below.



Extend microphone extension cord over notched portion of protective case.

After securing the cables of the sound level meter, the case should be placed underneath the three legs of the tripod as shown below. Coil the excess cable length and store it inside the case. Tape the microphone extension cord along the tripod to avoid tripping and noise contamination (wind).

Tape microphone extension cord along tripod.

## 1.4 SLM Setup Procedure

### 1.4.1 Data Storage Card - 4.0 GB Memory (CF/SD) Card

1. Insert an empty 4 Gigabyte memory card into the B&K 2250 Analyzer. Upon inserting the CF/SD card, the B&K 2250 Analyzer should acknowledge the card and display the prompt to accept the card. Click "Yes" to this.

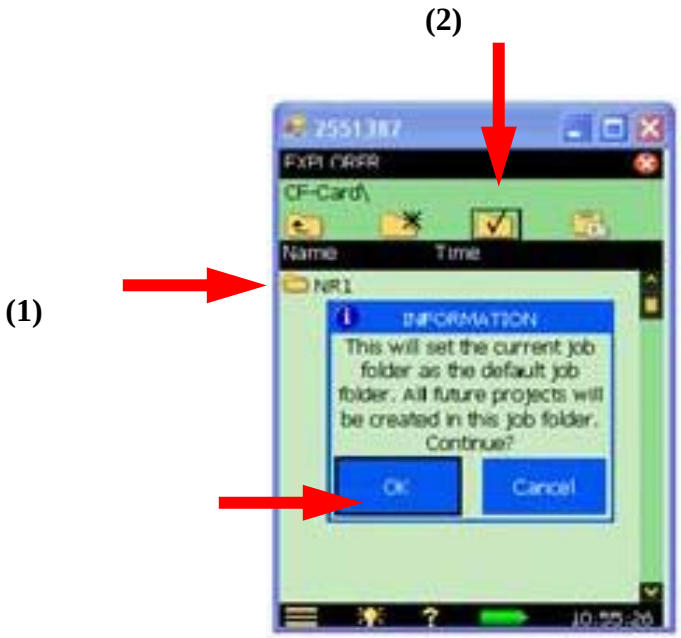

2. Select the "Main Menu" which is shown by three bars to the lower right on the B&K 2250 Analyzer screen as shown above left. Then select the "Explorer" (see below) option so that a folder can be created on the CF/SD card.

3. The next step involves creating a folder on the CF/SD card in which to store the noise data. Creating a new folder is done by selecting the folder icon with a star as shown in the figure below left. A prompt will display that a new job folder will be created. Select "Ok".



4. Renaming the folder is the next step. Select the folder, right click mouse button, and then select the "Rename" option. Choose the name of the folder appropriately to help with identification of noise monitoring location during data analysis and processing later (*e.g.*, MEADOWBANK030308).


5. Once the folder has been renamed, the folder must be identified as the default for data storage. This is done by selecting the folder itself and selecting the "Open" option (1 below). Now select the folder icon with the check mark (2 below) on it to set the current job folder (NR1 in photo below) as the default job folder, *i.e.*, all measurements will be stored within this folder.



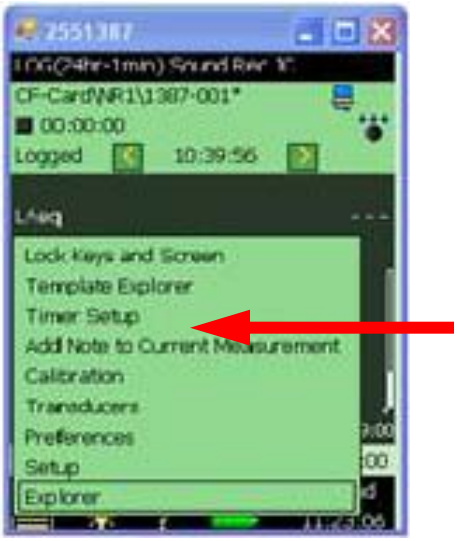

6. Observe the file path that is shown at the top of the display screen, it should display that the CF/SD card is at the top level and that the folder (NR1 in photo below) is one level below, *i.e.*, "CR-Card\NR1" as is shown in the below left screen.

7. Exit the “Explorer” screen by selecting the red “x” at the top left of the display screen.

### 1.4.2 Monitoring Template

The 2250 SLM is loaded with 10 standard monitoring templates. Each of the 10 standard templates performs a different type of measurement. The standard templates can be modified and saved as a Project Template to retain specific display settings and measurement setups. The template itself does not store any measurements. A Project Template named “MEADOWBANK 24hr LOGGING” has been designed to conduct the 24 hr noise monitoring. Use the following procedures to load the template.

1. Select the “Main Menu” and select the “Template Explorer” option as shown below. All the available templates will be shown on the screen.




2. Choose the “MEADOWBANK 24hr LOGGING” and then select “Open”.

3. The common measurement settings selected in this template are shown in the following table:

## MEADOWBANK 24hr LOGGING SETTING

| | | |
|---|---|---|
| **Input** | | |
| Input | Top Socket | |
| Trans. Used | 4152_0 (########) Check serial # on mic | Outdoor kit |
| Sound Field Correction | Free-field | |
| Extended Low Frequency | Off | |
| **Frequency Weightings** | | |
| Broadband (excl.Peak) | AZ | Z is linear |
| Broadband Peak | A | |
| Spectrum | Z | |
| **Bandwidth (1/3-octave)** | | |
| **Statistics** | | |
| Broadband Statistics based on | LAF | |
| Spectral Statistics based on | LXF | |
| Percentile 1 | 1 % | |
| Percentile 2 | 5 % | |
| Percentile 3 | 10 % | |
| Percentile 4 | 50 % | |
| Percentile 5 | 90 % | |
| Percentile 6 | 95 % | |
| Percentile 7 | 99 % | |
| **Measurement Control** | | |
| Preset Logging Time | 1.00:30:00 | 1 day and 30 minutes |
| Logging Period | 00:01:00 | 1 minutes |
| Synchronize with Clock | Yes | Save at 1:00, 1:01, 1:02 |
| **Logged Broadband** | | |
| Full Statistics | Yes | |
| Broadband Parameters | Selected | |
| Parameter 1 | LAeq | |
| Parameter 2 | LApeak | |
| Parameter 3 | LAFmax | |
| Parameter 4 | LAFmin | |
| Parameter 5 | LZeq | |
| Parameter 6 | LAIeq | |
| Parameter 7 | LCeq-LAeq | |
| Parameter 8 | Overload | |
| **Logged Spectrum** | | |
| Full Spectral Statistics | Yes | |
| Spectrum Parameters | Selected | |
| Spectrum | LZeq | |

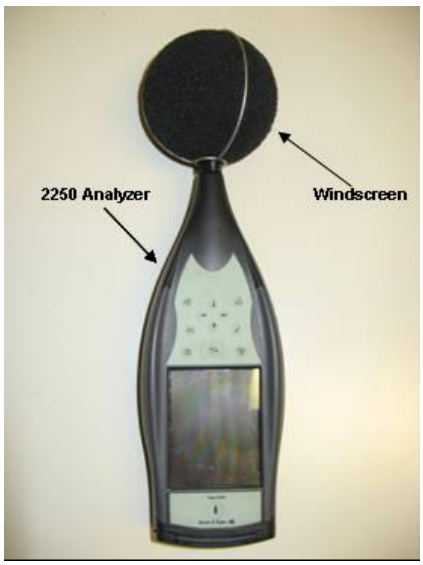
## MEADOWBANK 24hr LOGGING SETTING continued

| | | |
|---|---|---|
| **Level Trigger (OFF)** | | |
| Trigger | Off | |
| Start Slope | Rising | |
| Start Level | 50 dB | |
| Start Duration | 2 s | |
| Stop Level | 40 dB | |
| Stop Duration | 2 s | |
| Parameter | LAF (SPL) | |
| **Sound Recording** | | |
| Recording Control | Automatic | |
| Recording Quality | Fair (6.6 kHz) | |
| Recorded Signal | Input Z-weighted | |
| Automatic Gain Control | On | |
| Duration Limits | Off | |

## 2.0 SHORT TERM MONITORING CONFIGURATION

The following components are for short term monitoring:

- 2250 SLM;
- Microphone and Preamp assembly;
- Windscreen;
- External Compact Flash Memory Card (CF/SD-Card);
- Tripod; and
- Tripod mounting bracket.



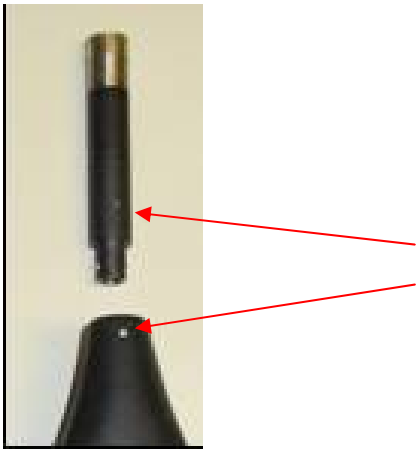

Since short term measurements rarely require an external power source. The B&K 2250 internal battery is typically used as the power source which can supply the meter for approximately 7 hours of operating time. The battery icon will display the estimate battery life remain in the internal battery. The photo on the left shows the hand-held configuration assembly.

### 2.1 B&K 2250 Hand-held Configuration

1. Connect the microphone to the pre-amplifier.

Option:
3 m extension cable can be inserted here for extension purposes.
(*e.g.*, ventilation fans on building wall)

2. Insert the microphone and pre-amplifier component into the B&K Analyzer making sure to line up the dot on the preamplifier with the dot on the B&K Analyzer.




3. Connect the windscreen to the microphone-preamplifier.


4. Mount the SLM on the tripod with the tripod adaptor.

## 2.2 Frequency Analyzer Template

Select the "Main Menu" and select the "Template Explorer" option as shown in Section 1.4.2 above. All the templates available will be shown on the screen. Choose the Project template named "MEADOWBANK SHORT-TERM FREQ ANALYZER", and then select "Open". This template is setup so that the B&K 2250 Analyzer records the frequency content in 1/3-octave measurements and broadband sound level measurements simultaneously. The measurement settings selected in this template are shown in the following table:

**MEADOWBANK SHORT-TERM FREQUENCY ANALYZER SETTING**

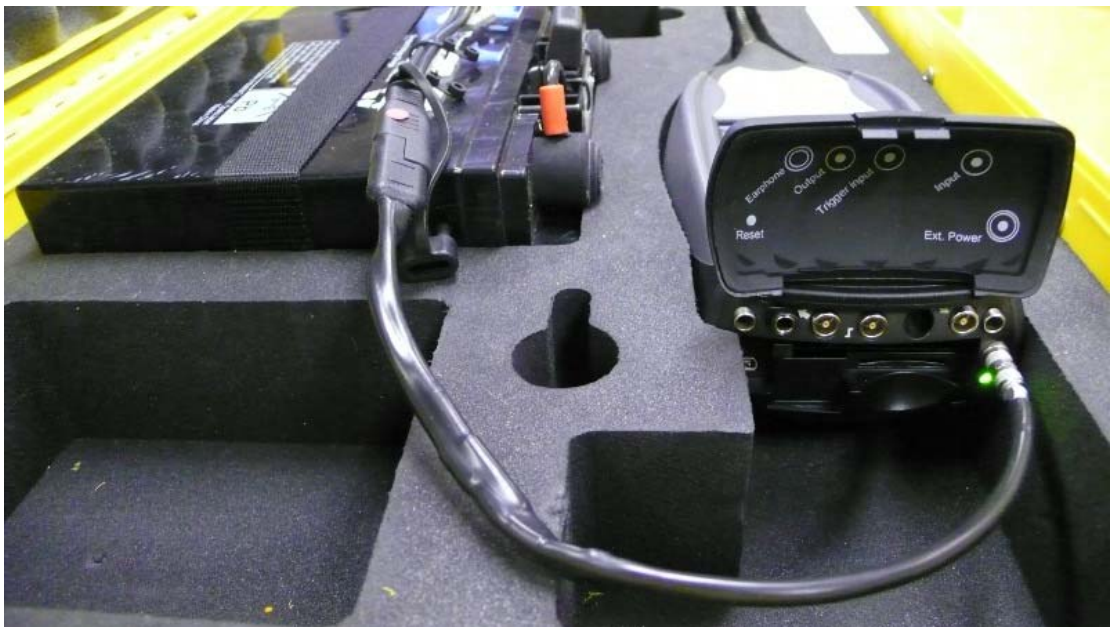
| | | |
|---|---|---|
| **Input** | | |
| Input | Top Socket | |
| Trans. Used | 4189 (#######) Check serial # on mic | mic with preamp |
| Sound Field Correction | Free field | |
| Windscreen Auto Detect | On | |
| Extended Low Frequency | Off | |
| Trigger Input | None | |
| **Frequency Weightings** | | |
| Broadband (excl.Peak) | AZ | Z is linear |
| Broadband Peak | Z | |
| Spectrum | Z | |
| **Bandwidth (1/3 Octave)** | | |
| **Statistics** | | |
| Broadband Statistics based on | LAF | |
| Spectral Statistics based on | LXF | |
| Percentile 1 | 1 % | |
| Percentile 2 | 5 % | |
| Percentile 3 | 10 % | |
| Percentile 4 | 50 % | |
| Percentile 5 | 90 % | |
| Percentile 6 | 95 % | |
| Percentile 7 | 99 % | |
| **Measurement Control** | | |
| Measurement Mode | Manual | |
| **Sound Recording (Off)** | | |

## 3.0 POWER SUPPLY

### 3.1 Panasonic 12 Volt External Battery Charging

A long term measurement duration can be anywhere between 7 to 36 hours. When an external batter supply is used, the 2250 m draws first from it until it is depleted. When the fully charged external battery is depleted (roughly 3 days) then the meter begins to draw from the internal power supply (roughly 7 hours). To recharge the 12 Volt Panasonic batteries used for long term measurements do the following:

- Connect the battery power supply cord to the battery charge cord;




- NOTE: The battery charger input rating is 120V, connecting it directly to a 220-230V AC supply will DESTROY IT!

- Connect the battery charger to the power outlet and observe the colour of the battery chargers LED.

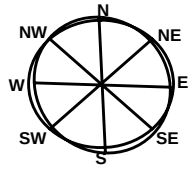
    - GREEN - battery is being charged, NOT READY
    - YELLOW - battery is being charged, READY FOR USE
    - RED - battery malfunction or bad connection

### 3.2 2250 SLM Internal Battery Charging

Connect AC/DC power supply adaptor to 2250 SLM power inlet as shown in the photo below. The 2250 internal battery will take up to 10 hours to charge. The battery will typically last 7 to 8 hours in warm temperature.

## 4.0 FIELD MEASUREMENT RECORDS

Important information such as field observation, measurement location, weather, acoustic environment must be recorded prior to any measurement period. The following field record sheets shows example for the record entries in Long Term and Short Term Measurements:

| | | |
|---|---|---|
| MONITORING STARTS | | |
| Operator: | | |
| Location: | | |
| Noise Meter Start Time: | | |
| Date: | | |
| Calibration complete ?: | | |
| Sensitivity | | |
| Derviation | | |
| Time of Calibration: | | |
| Battery Power Check: | Good  | Poor  |
| Photographs of Setup (Y/N) | | |
| Photographs of Surrounding (Y/N) | | |
| Check available disk memory (Y/N) | | |
| Cloud cover: | cloudy | partly cloudy |
| Height of cloud (feet): | 0-10,000 | 10,000-25,000 |
| Air Temperature (C): | | |
| Wind Speed (km/hr): | | |
| Wind Direction:<br>North wind (wind blows from North) |  | |
| Barometric Pressure (kPa): | | |
| Relative Humidity (%) | | |
| Precipitation: | none | drizzle |
| GENERAL SITE DESCRIPTION | | |
| GPS Location | Latitude | Longitude |
| | | |
| Type of Ground Surface: | | |
| Acoustic Environment: | | |
| Traffic | | |
| Human activities | | |
| Animal | | |
| Other noise sources | | |
| | | |
| | | |
| | | |
| MONITORING ENDS | | |
| Operator: | | |
| Record Data File Name: | | |
| Total Monitoring Period | | |
| Noise Meter End Time: | | |
| Date: | | |
| Calibration complete ?: | | |
| Sensitivity | | |
| Derviation | | |
| Time of Calibration: | | |

# 5.0 CALIBRATION

## 5.1 Calibrator

The 2250 SLM requires regular calibration to confirm the meter meets the precision requirement. It is mandatory to perform a calibration before and after each measurement program. Calibration is carried out via the B&K 4231 Calibrator shown in following photos.

Without case

With case

## 5.2 Calibration Procedure

The following steps are to be taken for proper calibration:

1. Choose the Main Menu to access the “Calibration” option as shown below.

2. Insert the B&K 4231 Calibrator on to the microphone; pushing it until it becomes flush (bottoms out). Press the start button. The way in which the calibrator is installed for the hand-held and outdoor kit configuration is shown below. There are two ways of checking that the calibrator is working. The first is by simply turning it on prior to inserting it onto the microphone and listening. Alternatively, confirming that the LED light on the calibrator is lit.


Outdoor Calibration Configuration


Hand-held Calibration Configuration

3. On the display screen the "Start Calibration" should appear. Select this and let the calibration begin.

4. It is important to conduct the calibration in a quiet environment (*e.g.*, no car engine idling or conversation). High ambient noise will disrupt calibration.

5. Observe the dB level in the 2250 SLM display measuring the calibration signal. This level should be at or very close to 94 dB.


6. Just before the end of the calibration, the meter will display "New Sensitivity" information. This information should be documented on the "Noise Field Sheet" for later use (see Noise Field Sheet form in Section 4 above). Note that the value "Deviation from last" should be no more than ±0.1 dB. Repeat the calibration if the deviation exceeds the ±0.1 dB limit.

7. Select yes to "Accept calibration?" and then "Exit Calibration".

### 5.3 High Deviation Level

The following may be reasons for the deviation value being consistently outside the acceptable limit of ±0.1 dB during calibration:

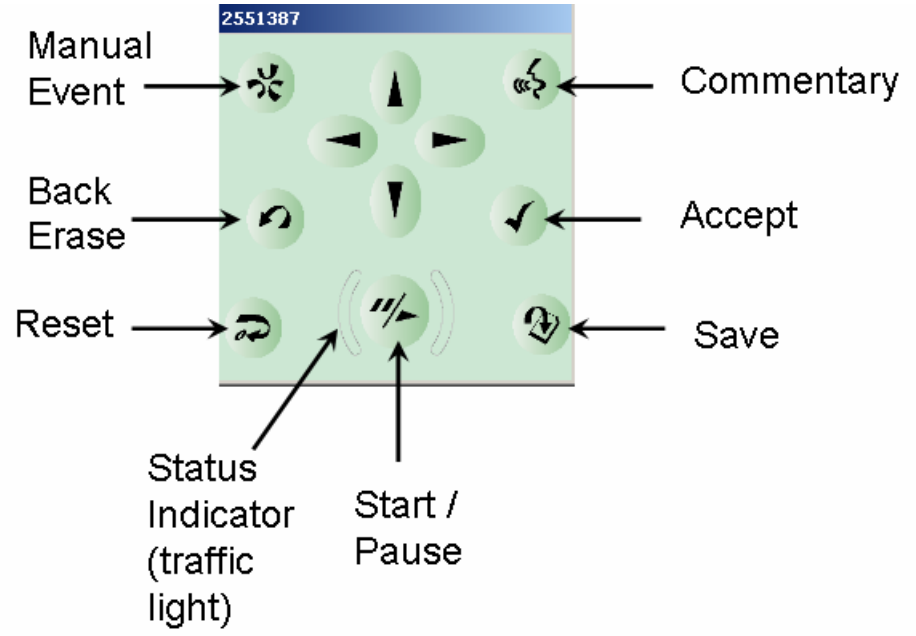
- High humidity levels;
- High ambient noise level surrounding the calibration environment; and/or
- Poor connection between the preamplifier and the B&K outdoor kit body. The preamplifier should be firmly screwed into B&K outdoor kit body; however, not so tight as to damage the fine threads of the preamplifier, or not to be able to unscrew the amplifier after use.

## 6.0 START NOISE MONITORING

After completing the setup and calibration, the following steps are to be carried out to begin noise measurements during long-term monitoring:

1. Press the “Reset Measurement” button.

2. Press the “Start” button.



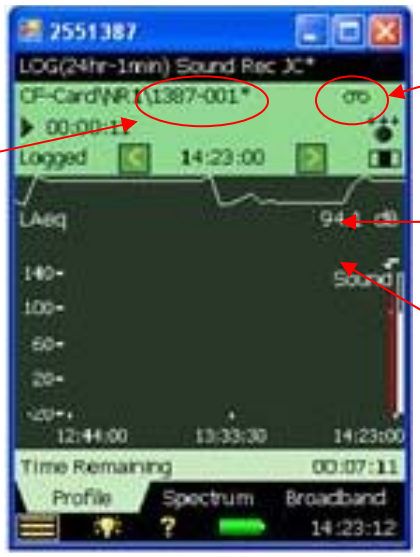

Because the measurement control setup is manual during short-term monitoring, you will have to repeat the following steps for each measurement:

- Reset
- Start
- Stop/Pause
- Save

The following information should be recorded on the Noise Field Sheet shown in Section 4:

- Save file number
- Location of measurement
- Overall level

Upon starting a measurement, one will see a time history forming which fluctuates with time as shown in the below figure.



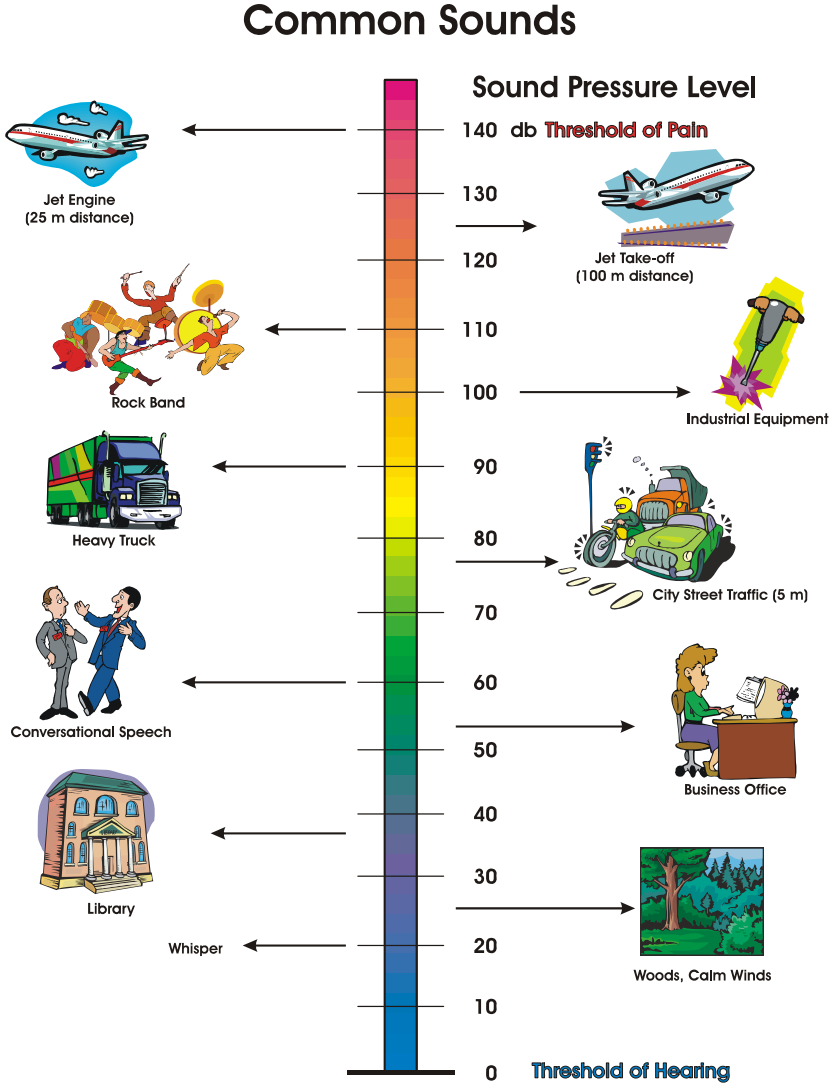

Sound recording

File name for data storage, asterisk * indicates file has not been saved

"Real Time" Time History Plot

Instantaneous Noise Level

It is recommended to remain silent for a minute after starting a measurement so as to let the meter "settle-down" and to determine whether the noise levels being recorded are representative for the study area. The following figure lists some typical noise level ranges for different environments. It should be used as a rough guide when on site taking noise measurements.


Common Sounds
Sound Pressure Level
140 db Threshold of Pain
130
120
110
100
90
80
70
60
50
40
30
20
10
0 Threshold of Hearing
Jet Engine
(25 m distance)
Jet Take-off
(100 m distance)
Rock Band
Industrial Equipment
Heavy Truck
City Street Traffic (5 m)
Conversational Speech
Business Office
Library
Whisper
Woods, Calm Winds

## 7.0 POST MEASUREMENT PROCEDURES

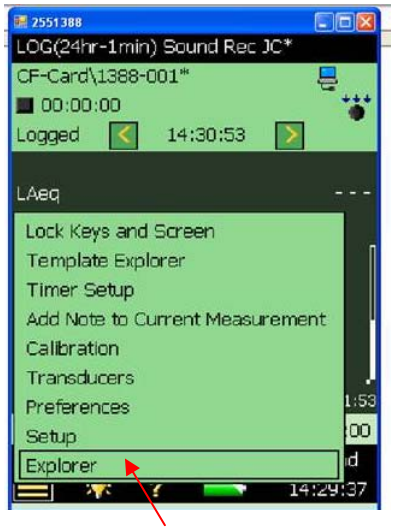
After completing a long-term noise measurement (*i.e.*, after 24 hours has passed), it is time to retrieve the equipment from the field to set it up at some other desired location.

### 7.1 Data Check

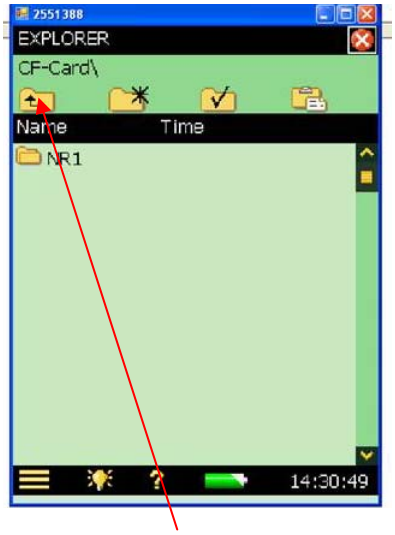
Prior to completely dismantling the equipment, the quantity of the data that has been recorded should be verified.

A series of checks can be performed to confirm that the noise data has been collected. Prior to removing the CF/SD card from the B&K 2250 Analyzer, the amount of data recorded on the CF/SD card should be checked on the 2250 Explorer display. As a general rule of thumb, a 24 hour noise measurement should represent approximately 2.4-2.7 Gigabytes of data (or thereabouts). This leaves about 1.6 Gigabytes of storage space remaining on the card.

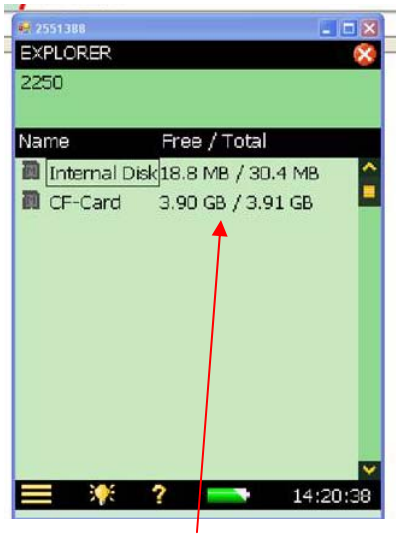
Select the Main Menu to access Explorer. Select the up one folder icon (folder with up arrow on it) to view both the "Internal Disk" and the "CF/SD card" as shown below.




Choose Explorer




Choose Up one level




View "Free/Total" of each storage device

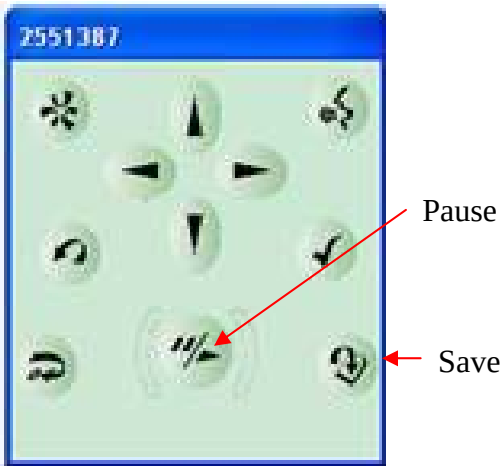
In the example above, it can be seen that there is 3.90 Gigabytes of free data storage space available on the CF/SD card. Note Explorer displays "Free" space on the storage medium and not used space. This means that 0.01 Gigabytes has been used; not enough for a 24 hour monitoring period. Again, approximately 1.6 Gigabytes of free data storage space should be available following a 24-hour monitoring period.

### 7.2 Save

The recorded data will be saved automatically into the specified file upon completion of the specified measurement period (24 hours). However, if the measurement period is terminated before the specified period, the data must be saved manually.

Only save the file if the specified measurement period has not been exceeded.

In such case, the SLM is still recording upon arrival. The data record file display on the top will show an asterisk '*' at the end of the filename (*e.g.*, CF-card\Project001*****). Press the Pause button and then the Save button.




### 7.3 Calibration

Before powering down the B&K 2250 Analyzer, the sound level meter needs to be recalibrated. Following procedure outlined in Section 5 for post measurement calibration.

## 8.0 DATA DOWNLOAD

The data download requires the following steps:

1. Connect CF/SD card to the card reader;

2. Activate the B&K BZ5503 software to copy data files from CF/SD card into archive files on a computer;

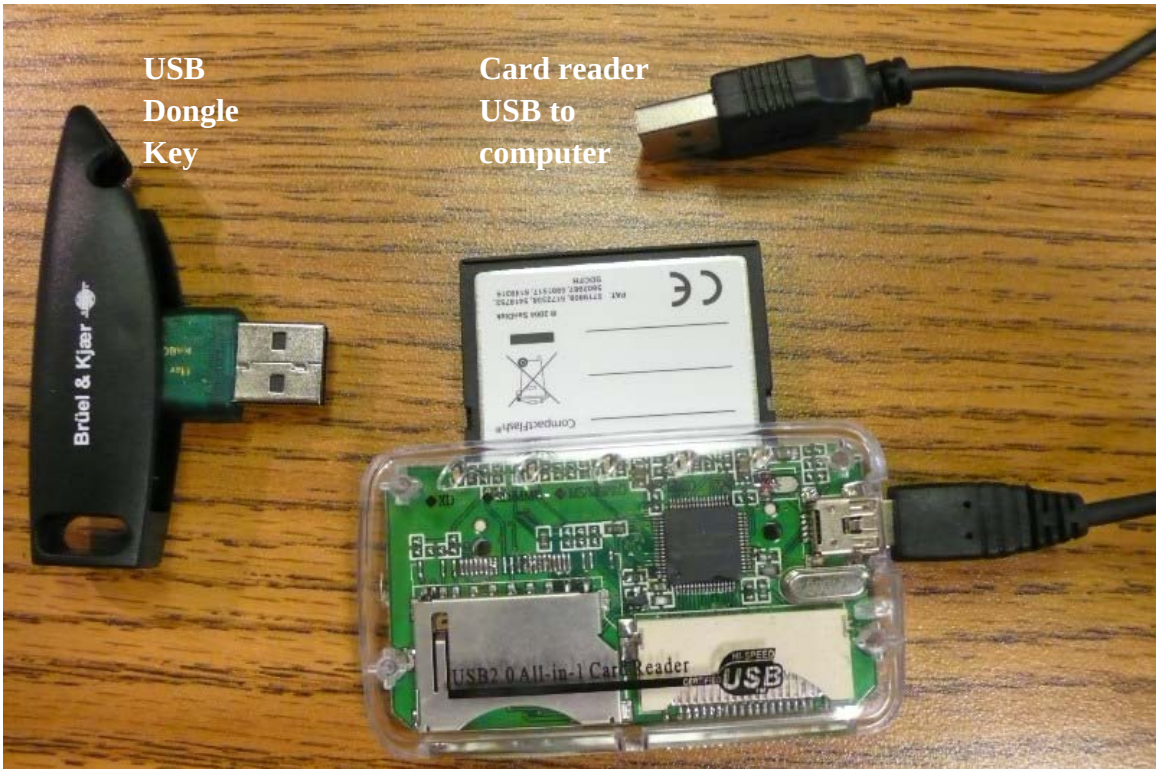
3. Export the archive file to a format for the Evaluator 7820-7821 Software; and

4. View recorded data in Evaluator 7820-7821 Software.

The following equipment is required to complete the data download:

- Computer with USB port;
- CF/SD card reader; and
- B&K USB dongle key for the use of the B&K Evaluator software.

Refer to the document “BZ – 5503 Data Download Procedure” provided with the noise monitoring equipment for further details.



### 8.1 CF/SD Card Reader and USB Dongle Key

After connecting the dongle key to the computer, start/run the B&K BZ 5503 software and connect the card reader using the computer USB connection as shown in the figures below:

Insert B&K Dongle

Remove CF/SD card from 2250 Analyzer and insert into card reader

Connect USB connection to USB port

### 8.2 Data Archive

The data from each 24-monitoring location should be archived and the entire archive directory should be burnt to a DVD. A typical 24 hour monitoring program will occupy one 4GB DVD.

# 9.0 EQUIPMENT TROUBLESHOOTING CASE STUDY

The following are examples of potential equipment malfunctions and possible reasons for those malfunctions.

## 9.1 Failed Power Connection

The following reasons can result in external power supply failure:

- Loose power supply connecting cable;
- Uncharged battery; and
- Bad fuse.

## 9.2 Invalid Data Collection

Invalid data collection is typically found when analyzing the time history of the sound file. The data ends up having either higher or lower sound levels (dBA) than would be representative of the area. Regular field visits during the monitoring period to check on the measurement levels will reduce the potential for invalid data being recorded. The following are common causes of invalid data:

- Power failure;
- Poor weather – heavy rainfall, high wind gust;
- Tampering with sound level meters;
- No calibration check; and
- Incorrect setup.

### 9.2.1 Poor Weather: Wind Speed and Precipitation

Poor weather conditions are probably the biggest reason for invalid data. Poor weather conditions include rain and high winds. Long-term noise measurements are rarely if ever done during winter months. Ideal noise monitoring conditions require that wind be no more than 20 km/hr (5.6 m/s) and that there be no precipitation during the measurement period. High wind has the effect of masking the true noise at a distance from different sources. Flutter noise is a type of noise due to velocity gusts impacting the microphone. In both cases the data collected during these non ideal conditions must be removed in order to have valid noise data set. The Energy Resources Conservation Board (ERCB) has established guidelines, namely, Directive 0038, for “Favourable summertime weather conditions” as shown in the below table:

| Parameter | Preferred Condition |
|---|---|
| Ground Cover | No snow, water, or ice (frozen) ground cover. |
| Precipitation | No steady precipitation, monitoring invalid. |
| Wind Speed | Wind speed limits (noise data may be invalid if limits are exceeded):<br>• Less than 500 m from noise source<br>  • Upwind: 10 km/hr limit<br>  • Crosswind: 15 km/hr limit<br>  • Downwind: 15 km/hr limit<br>• 500–1000 m from noise source<br>  • Upwind: 5 km/hr limit<br>  • Crosswind: 10 km/hr limit<br>  • Downwind: 10 km/hr limit<br>• Greater than 1000 m from noise source<br>  • Upwind: less than 5 km/hr limit<br>  • Crosswind: 10 km/hr limit<br>  • Downwind: 10 km/hr limit<br>24-hour noise sampling period: there should be at least 3 hours of wind blowing directly to the noise receptor in the nighttime sampling period (22:00 to 7:00) and 3 hours in the daytime sampling period (7:00 to 22:00). |

When doing a long-term noise measurement, it is not always possible to determine whether rain has occurred over the entire 24 hours of the study. The possibility of rain should be investigated prior to the noise field trip. The following website is useful for determining weather conditions across Canada: www.theweathernetwork.com or http://www.weatheroffice.gc.ca/canada_e.html.

In addition, a couple of indicators may help determine whether rain has occurred including:

- Visible signs of water on the protective sound level meter case and the surrounding ground.

- Cross referencing the B&K Evaluator sound file with the weather data obtained from the site weather station. If rain can be heard upon listening to the sound file, and the humidity is close to 100 %, then there is good reason to believe that rain occurred during that time period.

### 9.2.2 B&K 2250 Analyzer Calibration Fault

Calibrating the sound level meter before and after each measurement is a necessary part of the noise monitoring process. Not carrying out this necessary step can result in invalid data. Calibrating the noise level meter essentially tests the B&K 2250 Analyzer's ability to sense correct noise levels. The B&K 4231 calibrator itself must have new or fully charged batteries so that it too outputs the correct test signal (94 dBA at 1000 Hz). As an example during one noise field study, the microphone on the B&K 2250 Analyzer was found to become wet from the rain. Upon performing a post measurement calibration, the B&K 2250 Analyzer was found to be observing larger than normal values. Typically, the B&K 2250 Analyzer outputs a reading in the range between 49-52 mV/Pa (millivolts per Pascal). With the moisture in the microphone, the values were found to be much higher than this. After the water evaporated, the calibration was again found to be in normal range.

# 10.0 EQUIPMENT MAINTENANCE

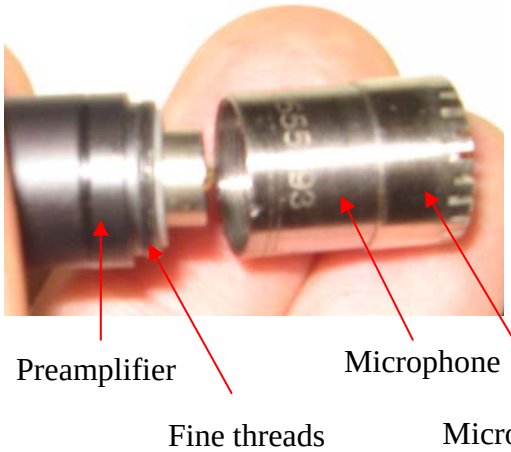
## 10.1 Microphone Maintenance

The following maintenance procedures are recommended keeping order to maintain the microphone in good working order:

- When not in use, keep the microphone in an environmentally controlled area with moderate to low humidity levels, as humidity will alter the sensitivity of the microphone. Condensation of water vapour within the microphone can cause significant negative effects, the worse of which is electrical continuity between the diaphragm and the back plate. Thus, it is necessary to prevent the microphone from coming into contact with any liquid whatsoever. Keep the microphone and preamplifier assembly in the designated case when not in use for long periods of time as shown in the figure below:


- When connecting the microphone to the preamplifier or the outdoor kit body, thread the microphone VERY CAREFULLY to avoid damaging the threads. Do not remove the microphone shield as the microphone drum can fall out and become damaged or lost (see photos below).

- The Microphone and SLM should be calibrated every two years.




### 10.2 B&K 2250 Analyzer Maintenance

The following maintenance procedures are recommended to keep the B&K 2250 Analyzer in good working order:

- Keep the Analyzer in the protective case when not in use.
- Be careful not to drop the meter as the touch display screen can be damaged.
- Avoid using solvents when cleaning the touch display screen. Instead use a damp cloth as recommended by B&K.
- To remove the microphone extension cable, make sure to pull back the spring loaded sleeve gently before pulling the connection from the meter. If difficultly arises in removing the connection, put a cloth over the sleeve and use pliers to gently grip the cloth while pulling back to release the connection.
- The B&K 2250 Analyzer should be sent to the B&K North America service department every two years for maintenance. This facility is located at:

  Bruel & Kjaer North America
  2815-A colonnades Court
  Norcross, GA 30071-1588
  Phone: 800-332-2040
  Fax: 770-447-4033
  www.bkhome.com

### 10.3 B&K 4231 Calibrator Maintenance

The following maintenance procedures are recommended to keep the B&K 4231 Calibrator in good working order:

- Keep the calibrator in its case at all times. There is no need for the leather case to be removed except for when the batteries need to be changed.

- The B&K 4231 Calibrator should be sent to the B&K North America service department every year for maintenance. This facility is located at the same address as that given above.

### 10.4 Outdoor Microphone Assembly Maintenance

- Keep the windscreen on the outdoor microphone body, as this protects the microphone.

- Clean the windscreen from any debris that may accumulate on it after field work, as any build up of debris will serve to impede sound from being transmitted to the microphone.

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