Baffinland Iron Mines Corporation

Air Quality and Noise Abatement Management Plan

BAF-PH1-830-P16-0002

Rev 8

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TRACK CHANGES TABLE

A review and update of the Air Quality and Noise Abatement Management Plan has been undertaken, with the following salient revisions to the March 31, 2020 version (**BAF-PH1-830-P16-0002**, Rev 7).

Index of Major Changes/Modifications in Revision 8

Item No.	Description of Change	Relevant Section
1	Updated Introduction section to provide clarity on purpose and regulatory requirements.	1
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3	Updated air quality section to provide clarity and CAAQS	4.6
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ABBREVIATIONS

ASL	Ambient sound level
Baffinland	Baffinland Iron Mines Corporation
CAAQS	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of the Environment
CO	carbon monoxide
CO_2	carbon dioxide
CO_2 eq	Carbon dioxide equivalent
CSL	comprehensive sound level
CWS	Canada-Wide Standards
dBA	decibel-acoustic
DFO	Fisheries and Oceans Canada
EHS	Environmental, Health, and Safety
EIS	Environmental impact statement
EPCM	Engineering, procurement, and construction management
EPP	Environmental Protection Plan
ERCB	Energy Resources Conservation Board
GHG	Greenhouse gases
Leq	energy equivalent sound level
LSA	Local Study Area
Mary River Project	the Project
MTPA	million metric tons per annum
NCB	balance noise criteria
NIRB	Nunavut Impact Review Board
NO_2	nitrogen dioxide
NO_X	nitrogen oxide emissions
NWT	Northwest Territories
O_3	Ozone
OSHA	Occupational Safety and Health Association
PDA	Project Development Area
PM	particulate matter
PSL	permissible sound level
RSA	regional study area
SARA	*Species At Risk Act*
SO_2	sulphur dioxide
TSP	total suspended particulate matter
VEC	valued ecosystem component
ZOI	Zone of Influence

1 INTRODUCTION

1.1 PURPOSE

The purpose of this plan is to outline how potential Project impacts on air quality and noise will be managed throughout the lifecycle of the Project. Management processes and procedures include practices implemented at the Project to limit the potential for adverse impacts to local air quality, particulate and dust impacts, nuisance noise, and greenhouse gases. This document outlines the systems in place to mitigate and manage emission sources and activities that generate dust and noise at the Project. Applicable monitoring programs and roles and responsibilities are identified.

1.2 REGULATORY REQUIREMENTS

1.2.1 AIR QUALITY GUIDELINES

Ambient air quality guidelines and objectives are non-statutory limits (i.e., not legally binding) used to assess ambient air quality and guide air management decisions. The Government of Nunavut has established ambient air quality guidelines for several criteria air contaminants (CACs): total suspended particulate matter (TSP), particulate matter with an aerodynamic diameter of <2.5µm ($PM_{2.5}$), nitrogen dioxide (NO_2) and sulphur dioxide (SO_2) (Government of Nunavut, 2011). The Canadian Council for the Ministers of the Environment (CCME) developed Canadian Ambient Air Quality Standards (CAAQS) for $PM_{2.5}$, ozone (O_3), SO_2 and NO_2. The CAAQS, which were established as objectives under sections 54 and 55 of the *Canadian Environmental Protection Act, 1999*, are intended to manage air emissions and ambient air quality concentrations in a regional airshed and are used as a reference only for the Project. CAAQS are not intended to determine compliance at the fenceline for an industrial facility.

Workplace air quality is protected in Nunavut by the Schedule O Contamination Limits provided in the *Nunavut Occupational Health and Safety Regulations* (NU Reg 003-2016). The Project, however, presents an exception, whereby SO_2 and NO_2 monitoring data at the Milne Port and Mine Site accommodation buildings are instead compared to the Nunavut Ambient Air Quality Guidelines in recognition of prolonged exposure at the accommodation facilities (beyond a typical 40 hour work week assumed for occupational guidelines).

With respect to emissions from Project incinerators, the Canada-Wide Standards for Mercury (CCME 2000) and Canada-Wide Standards for Dioxins and Furans (CCME 2001) apply to incinerator stack testing.

1.2.2 NOISE

There are no regulations or guidelines in Nunavut that address environmental noise levels. However, many projects in the Northwest Territories have adopted Alberta Energy Regulator Directive 038 Noise Control Guidelines (Alberta Energy Regulator, 2007) as indicative of what is generally considered

acceptable with respect to noise levels from industrial activities in remote areas. Directive 038 Guidelines have been adopted for the Mary River Project.

DFO's *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters* (1998) apply to underwater blasting which may be required during the construction phase of the Project.

1.2.3 GREENHOUSE GAS EMISSIONS

Environment Canada current GHG reporting requirements stipulate that all persons who operate a facility that emits 50,000 tonnes of CO_2 eq or more of GHGs in a calendar year are subject to the reporting requirements and must report their emissions information to Environment Canada. The legal basis for the GHG reporting program is the Notice published annually in the Canada Gazette, Part I, under the authority of subsection 46(1) of the Canadian Environmental Protection Act, 1999.

In addition, the Nunavut Climate Change Strategy was outlined in October 2003 by the Department of Sustainable Development. One of the objectives of this strategy is to "encourage Nunavummiut, including government, non-government, industry, and the public to take action to control greenhouse gas emissions through energy management and alternative energy supply technology."

1.3 BAFFINLAND'S COMMITMENTS

Baffinland provides adequate resources to implement and maintain the Health, Safety, and Environment (HSE) Management System, including the necessary human, material, and financial resources. Baffinland's Sustainable Development Policy is presented in Attachment 1.

Baffinland also made a number of commitments during the Project Certificate review process, as well as the amendment of the Project Certificate in 2018 to increase the quantity of ore that could be transported to market. These commitments as well as the Terms and Conditions of the Project Certificate applicable to Meteorology, Climate Change, Air Quality and Noise are listed in Attachment 2. The Air Quality and noise Abatement Management Plan provides the mechanism by which Baffinland tracks its compliance to these commitments and Terms and Conditions of the Project Certificate.

1.4 RELATIONSHIP TO OTHER MANAGEMENT PLANS

This plan should be viewed in concert with the following additional plans prepared for the EIS:

- Health, Safety, and Environmental Management Framework
- Environmental Design Guidelines
- EHS Management Framework
- Hazard and Risk Assessment Methodology
- Environmental Protection Plan

- Borrow Pit and Quarry Management Plan
- Road Management Plan
- Interim Closure and Reclamation Plan.

1.5 UPDATE OF THIS MANAGEMENT PLAN

The Air Quality and Noise Abatement Management Plan is a "living document" and will be regularly updated based on management reviews (see Section 9), incident investigations, regulatory changes, or other Project-related changes.

Note that this plan has been updated to meet annual reporting requirements and addresses the Early Revenue Phase of the Mary River Project, amended to reflect the Production Increase to six (6) million metric tons per annum (MTPA). Therefore, any references to actions required along the future phases of the Project or components not yet constructed are not included.

2 TARGETED VECS

Targeted valued ecosystem components (VECs) for the Air Quality and Noise Abatement Management Plan are:

- Air quality
- Noise
- Greenhouse gas emissions and climate change.

2.1 AIR QUALITY

Both gaseous and particulate emissions can result in air contaminants such as Total Suspended Particles (TSP), particulate matter (PM10, PM2.5), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and carbon monoxide (CO), which can be measured as concentrations on a contaminant mass per volume of air basis ($\mu g/m^3$). Because of gravitational settling and other influences, particulates and associated metals can be deposited to the earth's surface and potentially accumulate in terrestrial aquatic systems. Here the contaminant is measured as deposition on a mass per area basis (g/m^2). Depending on the composition of particulates, this deposition can range from nuisance to environmental concern. The VEC associated with these contaminants is air quality.

Baseline air quality conditions for the Mary River Project are presented in Attachment 3.

2.1.1 KEY ISSUES AND CONCERNS FOR AIR QUALITY

Air quality key issues and concerns for the Project are listed in Table 1.

2.1.2 AIR QUALITY METRICS

For the Mary River Project, the concerns are mainly particulate deposition, SO_2 and NO_x, and greenhouse gas emissions (GHG). The air quality metrics are thus:

- TSP, $PM_{2.5}$ and total particulate deposition (dustfall)
- Sulphur dioxide (SO_2) and nitrogen dioxide (NO_2)
- GHG emissions.

TABLE 1: AIR QUALITY KEY ISSUES AND CONCERNS FOR THE PROJECT PHASES

Project Phase	Issue/Concern	Relevance
Construction	Dust concentration and deposition	Vehicle emissions will occur from transportation of materials and workers to the site. Fugitive emissions will result from earthworks, construction of roads, laydown areas, railway, and other infrastructure.
Operation	Project effect on ambient SO_2 concentrations	The Project will result in an increase in regional emissions of SO_2, a gaseous contaminant. Ambient SO_2 concentrations can increase airway resistance in exercising asthmatics for 10-minute exposures at concentrations of 1,000 µg/m^3 (Legge, 1995).
	Project effect on ambient NO_2 concentrations	The Project will increase regional nitrogen oxide emissions (NO_x). Ambient NO_2 concentrations have shown small, statistically significant, reversible effects for mildly exercising asthmatics for 30-minute exposures at concentrations of 560 µg/m^3. A direct link between ambient NO_2 exposure and vegetation effects is more difficult to establish.
	Project effect on ambient CO concentrations	The Project will increase regional CO emissions. Ambient CO concentrations can inhibit the blood's ability to carry oxygen to body tissues including vital organs.
	Project effect on regional acid deposition	The Project will result in an increase of NO_x and SO_2 emissions. Ambient NO_x and SO_2 form acidifying chemicals in the atmosphere, and are removed from the atmosphere by wet and dry removal processes (deposition). The deposition is represented as sulphur and nitrogen deposition.
	Project effect on ambient $PM_{2.5}$ concentrations	Respirable particulate matter ($PM_{2.5}$) and precursor $PM_{2.5}$ emissions are projected to increase due to the Project. Particulates with aerodynamic diameters less than 2.5 µm (i.e., $PM_{2.5}$) are of specific interest because they are linked with adverse human health response. $PM_{2.5}$ can be emitted directly from industrial facilities or can be formed in the atmosphere from precursor emissions.
	Project effect on O_3	Ozone (O_3) can affect the respiratory system. O_3 is not emitted directly. In fact, NO_x will reduce ambient O_3 levels due to reactions with nitrogen oxide emissions. Given the northernly latitude location, the photochemical production of O_3 due to the Project will be negligible and therefore is not addressed.
	Project effects on fugitive dust and metal deposition	Fugitive sources of particulates and metals will include mining, processing, handling, and storage of iron ore. The metal concentration of the ore concentrate will be higher than natural background levels. The ambient concentrations and deposition of metal compounds are therefore evaluated in addition to dust.
	Project effects on greenhouse gas emissions	Combustion of hydrocarbons produces carbon dioxide (CO_2), a greenhouse gas. Given the interest in greenhouse gases relative to potential global warming and climate change, estimates of greenhouse gas emissions are required.
Closure	Dust concentration and deposition	Vehicle emissions will occur from transportation of materials and workers to the site. Fugitive emissions will result from earthworks related to closure.

2.2 NOISE AND VIBRATION

High levels of environmental noise and vibrations can affect people by impairing their enjoyment of using the land. High noise and vibration levels can also affect wildlife, causing changes in behaviour or avoidance of affected areas, for at least temporary periods. Environmental noise and vibration levels are therefore the VEC selected for mitigation and monitoring.

2.2.1 BASELINE NOISE LEVELS

Pre-development background atmospheric noise levels are low, ranging from 25 to 35 dBA (refer to Attachment 3). Noise recorded at all three sites consisted mainly of wind, insect, and small animal or bird sounds; at the coastal sites, noises associated with flowing water and waves were also recorded. Differences between daytime and night time were small, and attributed mainly to noise from nearby human activities that could not be screened out.

Measured ambient noise levels at all three sites (2007 campaign) were lower than those typically found in remote rural areas, likely because of the lower noise contribution from wind in vegetation for the three sites as opposed to more southernly areas with higher-profile vegetation, which is more likely to generate wind-related noise.

2.2.2 KEY ISSUES AND CONCERNS FOR NOISE AND VIBRATION

Key issues and concerns for noise and vibration are presented in Table 2.

TABLE 2: SUMMARY OF KEY ISSUES AND CONCERNS FOR NOISE AND VIBRATION

VEC	Issue Identified and Reason for Selection of VEC	Indicator
Environmental sound levels	• Minimize disturbance of natural terrestrial wildlife use patterns in the region • Minimize impacts on seasonal human dwellings in the area of Milne Inlet	• A-Weighted Sound Levels (L_{eq} dBA)
Environmental vibration levels	• Minimize disturbance of natural terrestrial wildlife use patterns in the region	• Peak vibration levels (mm/s)

2.3 CLIMATE CHANGE AND GREENHOUSE GAS

"Controlling emissions must be done in ways that carefully consider Nunavut's developing economy by minimizing the negative impacts to the economy and, where possible, identify economic opportunities" (Nunavut Climate Change Strategy, October 2003).

At present, arctic-grade diesel fuel is the only economically viable source of energy for the Project. Baffinland is committed, however, to continuing investigation of alternative sources of energy to satisfy Project energy requirements.

3 MITIGATION MEASURES

3.1 LIFE OF PROJECT MITIGATION MEASURES

Mitigation measures that will be implemented over the life of the Project to minimize identified adverse impacts on air quality, noise, and vibration are outlined in this section.

- **Procurement Policy** - Baffinland`s procurement procedures will incorporate air emissions and noise standards for the purchase of all equipment and machinery used at the Project. Emission and noise standards will be based on Nunavut or Canadian regulatory guidelines, or best available technologies. This includes purchase of the highest available tier engines for mobile equipment and power generation, where practicable.
- **LED Diesel-powered Lighting** - In 2018, Baffinland replaced all diesel-powered lighting systems at the crusher with high efficiency LED lights. This efficiency has reduced annual diesel fuel consumption by 30,000 L.
- **Fuel Supply** - Throughout the life of the project, Baffinland will endeavour to secure sources of fuel low in contaminants (low-sulphur fuel).
- **Improvements to Crushing and Stockpiling Operations** - The following Project design changes will contribute to dust control during crushing operations:
    - Installation of shrouding and other engineered controls on conveyors and the shiploader.
    - Minimizing drop distances (i.e., using adjustable stackers) for stockpiling activities.
    - Mechanical improvements at the crusher to reduce the need for use of ten diesel-fired frost fighter units down to three, resulting in a reduction of annual diesel fuel consumption by 33,300 L.
- **Power Supply** - Baffinland will investigate opportunities to use renewable energy sources and conventional power generators with higher emissions standards to reduce CAC emissions. Baffinland installed new GE low speed generators.
- **Heat Recovery Systems** - Baffinland is also currently investigating using thermo-electric or fluid heat exchange heat recovery systems from diesel generator exhaust and incinerator capture, however the feasibility of this is yet to be confirmed.
- **Exhaust Stack Design** - Exhaust stacks for power generators will be clustered within one to two stack diameters of each other to enhance plume rise, thereby reducing ground-level concentration of air contaminants.
- **Road Transportation Measures** - Coarse granular material will be used for road construction and well-defined haul routes will be used to reduce surface disturbance and reduce dust emissions during transportation.
- **Marine Vessel Operations** - Baffinland will continue to investigate and implement mitigation measures to reduce CAC emissions from large vessels, including use of alternative fuel and higher emission standards, but there is a limited ability to control the types of vessels and fuels used in

shipping to and from the site. Baffinland contracts market vessels that comply with all international and domestic standard regulations, which would include the choice of fuel of its carriers. Baffinland will discuss with our shipping partners whether feasible opportunities exist to reduce these sources of emissions. In 2020, a new sulphur cap was introduced to marine fuels; and vessels now burn either diesel or a fuel oil product that meets the sulphur cap requirements.

3.2 CONSTRUCTION AND CLOSURE PHASES

For the construction and closure phases, emissions sources include mobile equipment used for construction and the earthwork activities involved in preparing sites for Project infrastructure, roads, borrow pits, and quarry operations.

Activity-specific mitigation measures are outlined in the following management plans:

- Environmental Protection Plan (EPP)
- Borrow Pit and Quarry Management Plan
- Road Management Plan

The potential air quality impacts resulting from construction, operation, and closure activities are as follows:

- SO_2 and NO_2 levels from mobile equipment are expected to be lower than indicator thresholds during construction and closure activities.
- Elevated dust deposition levels are expected in the immediate vicinity of construction. These levels could occasionally exceed indicator thresholds.

3.2.1 MITIGATION MEASURES FOR CONSTRUCTION AND CLOSURE PHASES

Best management practices for dust control will be implemented throughout the construction and closure phases. These best management practices include:

- The use of coarse granular material for road construction.
- Watering roads, as necessary, to reduce visible plumes when it is practical to do so (i.e., when temperatures are above freezing).
- Using other dust suppressants (i.e. $CaCl_2$, Dust Stop®, DusTreat®, EK35® and other environmentally friendly products) as appropriate.
- Using well-defined haul routes to minimize disturbed surfaces.
- Limiting traffic to essential use over construction areas.
- Limiting speed over construction areas.

- Minimizing drop distances (i.e., using adjustable stackers) for stockpiling activities.

Implementation of these measures will reduce the magnitude and extent of dust deposition.

3.2.1.1 ANTICIPATED EFFECTIVENESS OF MITIGATION MEASURES

Dust emissions will primarily derive from traffic onsite and the Tote Road. These sources can be readily controlled because of ease of access. Enforcing strict speed limit for vehicles and the application of dust suppressants are expected to minimize dust generation from traffic.

3.2.1.2 EFFECTS OF MITIGATION FAILURE OR MALFUNCTION

Dust-suppression measures are not prone to failure, as such, but to relative degrees of success. All materials from which dust could be generated are non-reactive and low in contained heavy metals, such that there is no chemical risk to the environment. Dusting of vegetation surfaces has the potential to reduce plant growth rates, but most dust from Project activities will fall in close proximity to roads and well within construction site boundaries.

3.2.1.3 CONTINGENCIES

Principal contingencies for dust control are increased frequency of water spraying, and selection of a more effective dust suppressant in the case of road dust.

3.2.2 CONCLUSIONS FOR CONSTRUCTION AND CLOSURE PHASE

Elevated dust concentrations and deposition levels may occur in the immediate vicinity of roads and construction sites. Implementing best management practices for dust control will limit the magnitude and extent of impacts on air quality. Refer to the Dust Management Protocol (Attachment 7) for dust suppressant application procedures.

Given the localized nature of air emissions (mostly from mobile and construction equipment), the construction and closure phases are not expected to have significant impacts on air quality.

3.3 OPERATION PHASE

The ERP phase with the Production Increase Proposal is currently limited to the haulage and shipment of six (6) MTPA. The ore will be transported over the Tote Road to Milne Port by 140 tonne trucks. Ore will be stockpiled at Milne Port and shipped during the open water season.

On October 29, 2014, Baffinland submitted to regulators and stakeholders a proposed amendment, Phase 2 of the ERP, which would increase the annual ore production and shipment, and include the construction of a 110 km railway from the Mine Site to Milne Port. The proposed “Phase 2” is currently under review by the Nunavut Impact Review Board (NIRB).

3.3.1 MINE SITE AIR QUALITY

3.3.1.1 SOURCES OF AIR EMISSIONS

Activities likely to have an impact on air quality are:

- Mining activity (blasting)
- Mobile engine operation in and around the mine pit, including shovels, drills, loaders, and trucks
- Mine haul roads
- Ore crushing
- Ores stockpiles (lumps and fines) including stackers
- Loading of trucks for haulage of ore to Milne Port
- Waste incinerators' exhaust.

As with the construction phase, potential air quality impacts resulting from operation activities include the following:

- SO_2 and NO_2 levels from mobile equipment and power generators are expected to be lower than indicator thresholds during the operation phase.
- Elevated dust deposition levels are expected in the immediate vicinity of the mine, crushing, and stockpile areas. These levels could occasionally exceed indicator thresholds. The baseline level is even lower than the indicator thresholds (less than 1 g/m2/year). The predicted dust deposition, falls within the indicator threshold (55 g/m2/year), but is above the baseline levels over a distance. An impact zone at a distance of 14 km from the potential mine development was adopted based on data from Ekati.

3.3.1.2 MITIGATION MEASURES FOR THE MINE SITE

Mitigation measures incorporated in the design include:

- Exhaust stacks for power generators will be clustered within one to two stack diameters of each other to enhance plume rise, thereby reducing ground-level concentration of air contaminants.
- Addition of shrouds and hoods on crushing facility conveyors.

In addition to these design features, the following will be considered:

- Reducing drop distances to stockpiles
- Where possible, limiting speed on roads
- Dust suppression on roads

3.3.1.3 EXPECTED AMBIENT AIR CONTAMINANT CONCENTRATIONS FOR MINE SITE

Airborne contaminant dispersion modelling was carried out as part of the EIS (see EIS Volume 5). For air quality modelling, a 3-km zone was used to define the local study area (LSA) and a 1.5-km zone was used for evaluation of model results against appropriate air quality criteria.

Air quality parameter concentrations in excess of their respective thresholds are predicted, though these exceedances are generally confined to the LSAs and are fully reversible. Effects of the Project on air quality are predicted to be not significant.

3.3.2 TOTE ROAD

Ore haul traffic is expected to be the main source of dust generated along the Tote Road. Mitigation measures to minimize dust emissions will include regulating speed limits, and utilizing water and dust suppressants during snow free months. No other specific mitigation measures are provided. Table 9 outlines the correction actions that will be implemented if higher than expected dust deposition rates along the Tote Road are observed.

3.3.3 MILNE PORT

3.3.3.1 SOURCE OF AIR EMISSIONS

Activities likely to have an impact on air quality are:

- Ore stockpiles, loaders, and conveyors
- Power generation stations, including a series of generators operating on diesel, with boilers providing emergency backup heat
- Waste incinerators
- Shipping and loading activities, specifically ship loading; and
- Tug boat and ship operation around Milne Port.

3.3.3.2 MITIGATION MEASURES

The main mitigation measures that will be used to minimize dust generation are:

- Reduced vehicle speed on roads
- Minimize drop distance from stackers.

In 2020, as a result of continued engagement with communities and feedback regarding dust distribution at Milne Port, Baffinland implemented a pilot project to investigate the use of a crusting agent, DusTreat®, applied to stockpiles to mitigate wind-blown dust generation. Baffinland will continue to investigate the effectiveness of this new mitigation measure and evaluate alternatives to mitigate dust generation from stockpiling activities

3.3.3.3 EXPECTED AMBIENT AIR CONTAMINANT CONCENTRATIONS FOR MILNE PORT

Airborne contaminant dispersion modelling was carried out as part of the EIS for the ERP (for the larger Project as well - see EIS Volume 5). For air quality modelling, a 3-km zone was used to define the local study area (LSA) and a 1.5-km zone was used for evaluation of model results against appropriate air quality criteria.

Air quality parameter concentrations in excess of their respective thresholds are predicted, though these exceedances are generally confined to the LSAs and are fully reversible. Effects of the Project on air quality are predicted to be not significant.

3.3.4 AIRCRAFT OPERATION

Although aircraft will be a source of air emissions, dust, and noise, given the intermittent nature of this source and the short aircraft operation times in the Project area, air quality and noise impacts of aircraft use are expected to be minimal. Dust suppressant will be used on the airstrips as required. No other specific air quality or noise mitigation measures are provided for aircraft operation.

3.3.5 SHIPS OPERATION

During the open water season, up to sixty (60) Panamax ore carriers will dock at Milne Port. In addition to ore carrier operation, a total of two (2) tugs will be operating to assist the ships and resupply barges in navigation at the port.

The potential ambient air quality impacts from ship emissions were assessed in the EIS, using CALPUFF air dispersion model. The ship emissions will be infrequent and transient; and as such only short-term (1-hour) ambient concentrations of SO_2, NO_x, and NO_2 were analysed. The emissions at the port are expected to be within applicable threshold standards.

3.4 NOISE

For all phases of the Project, the major sources of noise will be from the following:

- Mobile equipment and machinery used for construction and facility maintenance
- Blasting events in quarries and at the mine
- Trucks used to haul run-of-mine ore and to haul crushed ore to Milne Port
- Crushing operation
- Power plant generators

Noise modelling was carried out as part of the FEIS and Amended FEIS (see Volume 5). For noise modelling, a Local Study Area (LSA) was defined for the Mine Site, Milne Port and Steensby Inlet as an area within 3 km of the potential Project development area (PDA). Noise criteria used for the impact assessment followed ERCB Directive 038 guidelines (see Section 5). This established a limit of 40 dBA, 1.5 km from the

PDA. For all sites, the predicted modelling results showed that the 40-dBA limit would not be exceeded beyond the LSA.

In terms of the 1.5-km evaluation zone:

- For Mine Site – to the southwest, the limit of 40 dBA is exceeded at the 1.5-km line by approximately 6 dB at the south end of the area; and
- For Milne Port – the limit of 40 dbA is not exceeded at the 1.5 km line; and
- For Steensby Site - the limit of 40 dBA is exceeded at the 1.5-km line, but only over water to the southwest. It should be noted that Milne Port noise levels were reassessed in 2013 due to the increased amount of activity planned for the site during the Early Revenue Phase of the Project. The Milne Port noise modelling study followed the same methodology and criteria utilized by previous studies conducted for the Mine Site and Steensby Inlet. The study and its predicted results are presented in Section 3 of Volume 5 of the Amended FEIS.

3.4.1 MITIGATION MEASURES FOR NOISE

The primary mitigation measure for noise is to ensure that all mobile equipment is equipped with mufflers and that all mobile equipment and machinery are well-maintained.

3.5 GREENHOUSE GAS EMISSIONS REDUCTION PROGRAM

Once the facilities are in operation and a baseline for GHG emission is established, Baffinland will bench-mark its operation against other similar mining operations and implement a Greenhouse Gas Emission Reduction Program.

4 ROLES AND RESPONSIBILITIES

4.1 ORGANIZATIONAL CHART

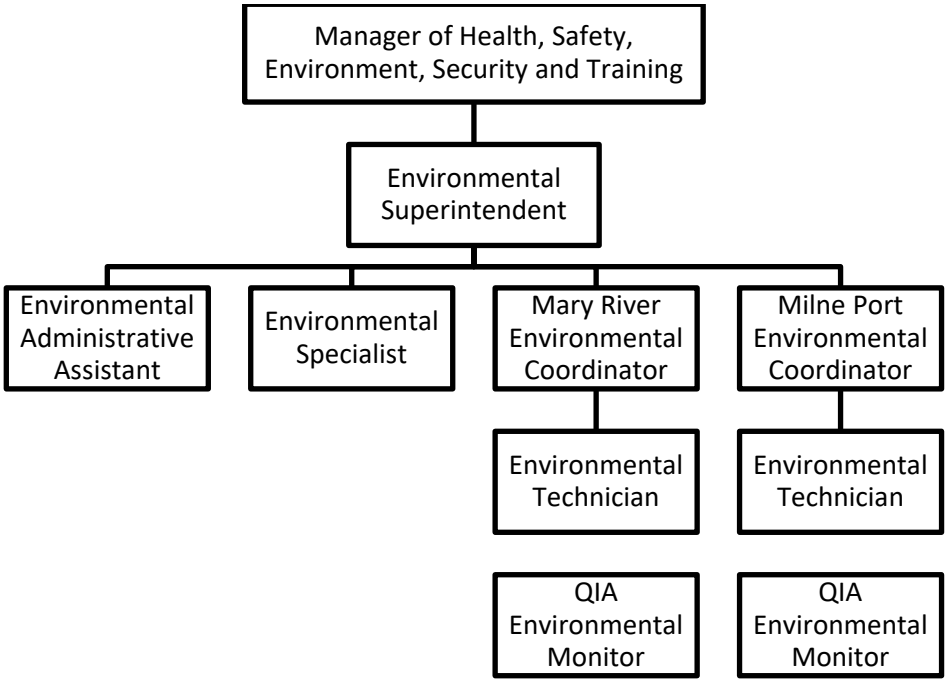

FIGURE 1: ORGANIZATION STRUCTURE FOR THE ONSITE ENVIRONMENT DEPARTMENT

4.2 ROLES AND RESPONSIBILITIES

The Baffinland Environmental and Sustainable Development Departments are organized into two parts, on site and off site. The organisational structure for the Mary River Project in relation to the environment discipline is shown in Figure 1. Communication channels are described as liaisons in the tables outlining the responsibilities and accountabilities in the following sections.

4.2.1 ENVIRONMENTAL PROJECT TEAM

4.2.1.1 THE BAFFINLAND ENVIRONMENTAL TEAM

The Baffinland Environmental Team will oversee all environmental and community works on site. The Baffinland Corporate Team responsibilities are summarized in Table 3.

TABLE 3: BAFFINLAND IRON MINES CORPORATION SENIOR MANAGEMENT

Baffinland Iron Mines Corporation Senior Management	
Position	**Responsibilities and Accountabilities**
Chief Operating Officer	- Reports to Baffinland's CEO - Overall accountability for the operation of the Project - Allocation of resources (human and financial) for the implementation of Baffinland's commitments and objectives related to health, safety and environment during operation - Accountable for on-site environmental, health and safety performance during operation
VP Sustainable Development	- Reports to Baffinland's CEO - Establish corporate environmental policies and objectives - Monitors and reports on Baffinland's performance related to environmental, health and safety policies and objectives - Liaise with regulatory authorities - Obtains necessary permits and authorizations - Monitors compliance with terms and conditions of permits and licences
Chief Procurement Officer	- Reports to Baffinland's CEO - Accountable for procurement and purchasing - Ensure that environmental commitments, policies and objectives are included in all contract documents
Director of Sustainable Development	- Reports directly to the VP Sustainable Development and indirect reporting and coordination with Chief of Operations - Liaises with the senior management, regulators and stakeholders - Ensures effective monitoring and auditing of environmental performance of departments and contractors on site and identifies opportunities for improvement - Monitors compliance with permits, licenses and authorizations - Ensures all regulatory environmental monitoring and reporting requirements (monthly, annual) are met - Leads and coordinates site permitting requirements - Initiates and oversees environmental studies

The Baffinland on-site Environmental Team will oversee all environmental activities on site. These responsibilities on site are outlined in Table 4.

TABLE 4: BAFFINLAND IRON MINES CORPORATION ON-SITE MANAGEMENT TEAM

Baffinland Iron Mines Corporation On-Site Environmental Team	
Position	**Responsibilities and Accountabilities**
Manager Heath, Safety, Environment and Security	- Reports directly to Senior Director, Health, Safety and Environment and Security - Indirect reporting and coordination with Operations Management - Overall accountability for environmental staff and performance at site - Coordinates implementation and monitors the performance of the Environmental Management System at site - Liaises with the senior management, regulators and stakeholders - Ensures effective monitoring and auditing of environmental performance of departments and contractors on site and identifies opportunities for improvement - Monitors compliance with permits, licenses and authorizations - Ensures all regulatory environmental monitoring and reporting requirements (monthly, annual) are met - Leads and coordinates site permitting requirements. - Initiates and oversees environmental studies - Oversees investigations and reporting of environmental incidents to regulatory bodies, stakeholders and senior management - Reviews and updates environmental management plans
Environmental Superintendent	- Reports to Manager Heath, Safety, Environment and Security - Specific accountabilities for environmental monitoring and reporting - Leads investigations and reporting of environmental incidents onsite - Serves as the liaison for regulators during onsite inspections and visits - Provides ongoing environmental education and environmental awareness training to all employees and contract workers - Oversees environmental database management - Prepares updates for management plans
Environmental Specialist	- Reports to the Environmental Superintendent - Specific accountabilities for environmental reporting and government agency requests - Executes environmental database management - Executes investigations and reporting of environmental incidents to regulatory bodies, stakeholders and senior management - Prepare updates for management plans
Environmental Coordinator	- Reports to the Environmental Superintendent - Specific accountabilities for environmental monitoring and reporting - Provides day to day direction to Environmental staff onsite - Serves as a liaison for regulators during onsite inspections and visits. - Provides ongoing environmental education and environmental awareness training to all employees and contract workers - Assists with environmental database management

Baffinland Iron Mines Corporation On-Site Environmental Team	
Position	**Responsibilities and Accountabilities**
	- Prepare updates for management plans - Assist with monitoring and sampling activities as per the project's management plans
Environmental Monitor and Technician	- Reports to the Environmental Coordinator or designate - Assists with environmental database management - Assists with monitoring and sampling activities as per the Project's management plans
QIA Environmental Monitor	- Works alongside the Baffinland Environment Department to ensure the proper implementation of all environmental management and monitoring plans - Acts as the QIA liaison for onsite environmental matters
Environmental Support Groups (Consultants, etc.)	- Assists with sampling, monitoring and reporting activities as required by permits, licenses and environmental management plans - Provides technical expertise to various environmental studies

4.3 TRAINING AND AWARENESS

Employees and Contractors working onsite will receive environmental training as part of the Site Orientation, to achieve a basic level of environmental awareness and understanding of their obligations regarding compliance with regulatory requirements, commitments and best practices.

The Environmental and Safety Leads and contractor supervisors will be provided with this Air Quality and Noise Abatement Management Plan, and will receive additional orientation with respect to the requirements outlined in this Plan. In addition, all supervisor level Employees and Contractors will be required to attend an Environmental Protection Plan (EPP) training session and will be provided with the EPP as a written guidance for their work.

Targeted environmental awareness training will be provided to both individuals and groups of workers assuming a specific authority or responsibility for environmental management or those undertaking an activity with an elevated high risk of environmental impact. Training will be delivered in the form of toolbox/tailgate meetings or other means as appropriate.

Content of the environmental component of the site induction will include, at a minimum:

- Location of environmental sensitivities
- Location of additional information on environmental matters
- Due diligence responsibilities
- Responsibilities related to waste management, spill reporting, noise management and road traffic rules
- Principles and necessary steps to avoid encounters with bears or other wildlife and what to do if one such encounter occurs.

With respect to this Air Quality and Noise Abatement Management Plan, Baffinland may contract out all or part of its air monitoring and noise survey programs. If contracted out, a well-defined scope of work will be developed that will identify:

- Specific locations for sampling
- Duration of the sampling campaign
- Analysis required
- Reporting format and requirement.

A call for tender will be sent to competent contractors, requesting the following:

- Qualification and expertise of the contractor
- Experience in northern climate
- Details of QA/QC for sampling and analysis
- Client references.

4.4 COMMUNICATION

Types of communications for which members of the team will participate include:

- Meetings and formal written correspondence with stakeholders and regulatory bodies.
- Site visits by community representatives
- Design, construction, and planning meetings
- Field inspections and monitoring reports disseminated by the Environmental Lead
- Electronic communication
- Tailgate/toolbox meetings
- Formal environmental awareness training.

Communication will be appropriately recorded and filed for future reference. Where appropriate, copies of communication will be forwarded to the Health, Safety and Environmental Leads as well as and the Vice President of Sustainable Development and HSE.

4.5 EXTERNAL COMMUNICATIONS

Effective forms of communication include the proactive notification to external stakeholders of Project activity. Project activity updates will be provided to the communities of North Baffin through various means, including regular meetings, public notices, and radio announcements as appropriate.

Baffinland will endeavour to maintain Community Liaison Offices to assist in this regard. Information on air quality and noise monitoring will be integral to this external communication effort.

4.6 AIR QUALITY

Ambient air quality guidelines and objectives are non-statutory limits (i.e., not legally binding) used to assess ambient air quality and guide air management decisions. Ambient air is defined as the air outside (beyond) an industrial property fenceline (also referred to as the Potential Development Area or PDA) where public access is restricted. The air quality inside of the fenceline is considered an occupational workplace and is assessed using different standards. In Nunavut, workplace air quality is protected by the Schedule O Contamination Limits provided in the Nunavut Occupational Health and Safety Regulations (NU Reg 003-2016, http://canlii.ca/t/52qsb). The exception to this situation is the comparison of the SO_2 and NO_2 monitoring data at the Milne Port and Mine Site accommodation buildings that is being compared to the Nunavut Ambient Air Quality Guidelines.

The Government of Nunavut has established ambient air quality guidelines for several criteria air contaminants (CACs): total suspended particulate matter (TSP), particulate matter with an aerodynamic

diameter of <2.5µm ($PM_{2.5}$), nitrogen dioxide (NO_2) and sulphur dioxide (SO_2) (Government of Nunavut, 2011). Table 5 presents the air quality guidelines and objectives adopted by the Project for the CACs.

Canadian Ambient Air Quality Standards (CAAQS) were established as objectives under sections 54 and 55 of the *Canadian Environmental Protection Act*, 1999 on May 25, 2013. The 2020 CAAQS are presented in Table 5 (Environment and Climate Change Canada, 2018). The 2020 CAAQS are not facility-level regulatory standards that are to be enforced at a property fenceline (also referred to as the Potential Development Area (PDA) boundary). The 2020 CAAQS are included in Table 5 for comparison purposes, although the adopted Project Standard for each CAC is based on the Nunavut standards or a provincial or Health Canada surrogate.

CAAQS were developed by the Canadian Council for the Ministers of the Environment (CCME) to manage air emissions and ambient air quality concentrations in a regional airshed; CAAQS are not intended to determine compliance at the fenceline for an industrial facility. Fenceline standards for ambient air quality are typically specified in the Project Certificate or the waste discharge (air) permit authorization – different jurisdictions use different regulatory instruments to identify the conditions that need to be met in order to maintain regulatory compliance with respect to ambient air quality. CAAQS are best suited as a tool to manage air emissions in regional airsheds that have multiple industrial sources. Regional airsheds typically have sensitive receptors (i.e. vulnerable populations such infants, elderly and those with respiratory ailments), major industrial air emissions and opportunities for achievable emission reductions. These airsheds often have multi-pollutant management needs. Regional airsheds differ based on the unique characteristics of local geography, meteorological conditions, and composition of human activity, including industrial activity.

Baffinland has committed to advancing an ambient air quality monitoring framework in consultation with the Government of Nunavut and ECCC. The potential applicability of the 2020 CAAQS to the Project was considered as part of the monitoring framework and it was determined that the 2020 CAAQS would be used for comparison purposes only with the objective to “keep clean areas clean” with respect to ambient air quality. Health Canada has requested to be kept apprised of the discussions with ECCC on the application of the CAAQS and any updated air quality monitoring.

Table 5 presents a comparison of NWT criteria, Nunavut guidelines, and CAAQS. The criteria refer to different averaging periods to account for potential short-term acute exposures and long-term chronic exposures. Based on the precautionary principle, the most stringent criteria were selected as the threshold for each contaminant indicator.

TABLE 5: PERFORMANCE INDICATORS AND THRESHOLDS FOR AIR QUALITY

Criteria Air Contaminant	Averaging Time	Units	Nunavut Ambient Air Quality Standards[1]	Northwest Territories Ambient Air Quality Standards[2]	2020 CAAQS[3]	Project Standard [5]
SO_2	1 hr	µg/m^3	450	-	183.35[4]	450
	24 hr	µg/m^3	150	-		150
	Annual	µg/m^3	30	-	13.10[4]	30
NO_2	1 hr	µg/m^3	400	-	112.85[4]	400
	24 hr	µg/m^3	200	-		200
	Annual	µg/m^3	60	-	31.97[4]	60
TSP	24 hr	µg/m^3	120	-	-	120
	Annual	µg/m^3	60	-	-	60
$PM_{2,5}$	24 hr	µg/m^3	30	-	27	30
	Annual	µg/m^3	-	10	8.8	10

NOTES:
1. Government of Nunavut (2011).
2. Northwest Territories (2014).
3. 2020 Canadian Ambient Air Quality Standards (2020 CAAQS) provided for context, not intended for use at facility fenceline for compliance; CCME 2014 .
4. CAAQS for these parameters are provided in parts per billion (ppb); these have been converted to µg/m^3 by the equation: Concentration (µg/m^3) = 0.0409 x Concentration (ppb) x molecular weight (Boguski, 2006).
5. Project Standards are from Nunavut Standards where available, or otherwise the most stringent available from a Provincial or Territorial Government.

Table 6 presents dust-deposition criteria for Alberta and Ontario. These criteria are based on nuisance considerations and are representative of the potential for aesthetic impact. The Ontario values have been recalculated to the same units as the Alberta criteria. All dust deposition criteria were used to assess the project.

TABLE 6: DUST DEPOSITION CRITERIA

Average Time	Alberta Residential and Recreational Areas	Alberta Commercial and Industrial Areas	Ontario Ambient Air Quality Criteria	Project Standard
1 month	53 mg/100cm^2/ 30 day	158 mg/100cm^2/30 day	70 mg/100cm^2/30 day	5.3 g/m^2/30 day
	5.3 g/m^2/30 day	15.8 g/m^2/30 day	7 g/m^2/30 day	
Annual	-	-	4.6 g/m^2/30 day	55 g/m^2/year
	-	-	55 g/m^2/year	

4.7 NOISE METRICS

There are no regulations or guidelines in Nunavut that address environmental noise levels. However, noise has been addressed in recent EISs developed for other mining projects in Nunavut (i.e., Meadowbank Gold Project, Doris North Gold Project, High Lake Project). These projects and other projects in the NWT have adopted Directive 038 Guidelines (Alberta Energy Regulator, 2007) as indicative of what is generally considered acceptable with respect to noise levels from industrial activities in remote areas. Directive D038 guidelines have been adopted for the Mary River Project. For an overview of Directive 038, see Table 7.

TABLE 7: ENERGY RESOURCES CONSERVATION BOARD DIRECTIVE 038 GUIDELINES

General Format of Directive D038	Directive D038 sets out permissible sound levels (PSLs), which must be met at all dwellings surrounding the Project development. These limits apply to operational noise only. The cumulative sound level from all energy-related (in this case Baffinland-related) development in the area is measured or predicted. This is called the comprehensive sound level (CSL) and is compared against the PSL. The CSL includes background ambient sound levels. The base PSL value is 40 dBA, which is based on a typical rural or remote ambient sound level (ASL) of 35 dBA, plus 5 dBA allowance for the industrial activity (Alberta Environment research showed that in general, people tolerate sound from energy facilities of up to 5 dBA above the ambient sound environment). The PSL can be increased to account for the presence of other industrial or transportation noise sources, such as road and rail traffic, and for the population density of developed areas. In remote pristine areas, an ASL adjustment, based on measured existing sound levels, can be applied, which might reduce PSL at these locations. For areas where there are no dwellings, a sound level limit of 40 dBA 1.5 km from the facility fence is applied.
Dwellings	A dwelling is defined in Directive D038 as a permanently or seasonally occupied residence, including trailer parks and campgrounds in regular consistent use. For assessment, the only dwelling near Baffinland-related activities is a seasonally occupied hunt camp at Milne Inlet. Worker residences, dormitories, and construction camps are specifically excluded as dwellings under Directive D038.
Noise Limit for Remote Area	Where no noise-sensitive receptors are located within 1.5 km of the facility, the CSL from the facility (facility noise plus ambient) must meet a PSL of 40 dBA Leq (night) measured at 1.5 km from the facility fenceline.

4.7.1 NOISE LIMIT AT FENCELINE

The fenceline is not defined for facilities such as those at the Baffinland sites, where there is no fence or other fixed facility boundary. For this management plan, the Mine Site, Milne Port and Tote Road area surface lease boundary was used as a proxy for the fenceline. Thus the PSL for the fenceline is 40 dBA 1.5 km from the mine lease boundary.

4.7.2 NOISE LIMIT FOR WORK CAMPS

Work camps such as those associated with the Project are specifically excluded from the requirements of Directive D038. These dwellings were considered, however, as it is important for worker health to maintain an adequate sleep environment. Interior noise can be characterized using balance noise criteria (NCB) curves. For sleeping areas in larger complexes, NCB ratings of NCB 28 to NCB 33 are generally accepted. A NCB rating of 33 has been adopted for the Project.

4.8 VIBRATION

Vibration impacts can be broken down into two zones: terrestrial (above ground, on land) and underwater.

4.8.1 TERRESTRIAL

Human perception of ground-borne vibration can be ranked as follows (Bender, 1996):

- Barely to distinctly perceptible - 0.5 to 2.5 mm/s ppv
- Distinctly to strongly perceptible - 2.5 to 6.25 mm/s ppv
- Strongly perceptible to mildly unpleasant – 6.25 to 25.4 mm/s ppv
- Increased potential for structural damage - 12.5 to 25.4 mm/s ppv.

The potential for structural damage increases for airborne vibration overpressure in excess of 120 dB (MOE, 1997).

4.8.2 UNDERWATER

Fisheries and Oceans Canada (DFO) has produced *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters* to protect marine wildlife, including fish and marine mammals from underwater vibrations (DFO, 1998).

Highlights of the guideline include the following:

- No explosive is to be knowingly detonated within 500 m of any marine mammal (or no visual contact from an observer using 7 x 35 power binocular).
- No explosive is to be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous pressure change (i.e., overpressure) greater than 100 kPa in the swim bladder of a fish.
- No explosive is to be detonated that produces, or is likely to produce, a peak particle velocity greater than 13 mm/s in a spawning bed during the period of egg incubation.

The guideline also presents tables of weight of explosive change versus distance and other estimation methods are provided to determine the potential impacts.

This guideline is relevant mostly for the construction phase of the Project (construction of docking facilities, creek/river crossings).

5 MONITORING

5.1 METEOROLOGY

Six meteorological stations have been established; two at the Mine Site, two at Milne Port, one at Steensby Camp and one on top of Deposit 1. The stations record air temperature, relative humidity, precipitation, barometric pressure, wind direction, and wind speed. Data collected from the meteorological stations are establishing a climatic record in key project areas. Details of the auto-stations are presented in Attachment 4 of this Management Plan.

During 2009, each station was retrofitted with new research technology being tested to determine its ability to transfer data remotely in real time. In August 2013, the Symbiotic Ware weather stations were replaced by Campbell Scientific Canada weather stations. The existing weather stations were completely rebuilt with new, calibrated rugged sensors and data loggers and the ability to transfer data in real time. One weather station was added to the top of Deposit 1 and a weather station was also added to the Port Site and Mine Site complexes. Campbell Scientific also provides both field and data services for all stations which includes both field maintenance and data management and QA/QC.

Tide gauges are installed annually at Milne Port to monitor relative sea level and storm surge (Refer to Attachment 2, Table 11 – Project Certificate commitments).

5.2 AIR QUALITY MONITORING

Potential sources of project-related effects on air quality include exhaust emissions from vehicles, mining activities, aircraft, generators and other equipment, emissions from camp incinerators, and fugitive dust emissions from road traffic during snow-free periods.

Inspection of facilities will ensure compliance with this Air Quality and Noise Abatement Management Plan.

Scheduled maintenance on mobile equipment and stationary equipment will ensure that emissions are in line with vendors` specifications and emission criteria.

The Dust Management Protocol (Attachment 7) discusses the procedures for applying dust-suppressants. Training/instruction on the use of dust suppressants will be provided to all employees and Contractors, as required.

5.2.1 AMBIENT AIR QUALITY MONITORING

Passive and active air quality monitoring will be conducted at specified locations within and outside the Potential Development Areas (PDA). Active monitoring will involve measuring TSP, $PM_{2.5}$, SO_2 and NO_2 in areas of activity at the Mine Site and Milne Port, as per Terms and Condition #8 (Attachment 2). Passive

sampling will constitute collecting dustfall samples. During both construction and operation, the monitoring program will focus on particulate and dust deposition.

Air quality data will be collected via active TSP, $PM_{2.5}$, SO_2, NO_2 sampling and passive sampling for dustfall and particulates, including metal deposition. Baffinland is also evaluating the implementation of active monitoring for particulate matter at select Project locations using remote battery operated equipment. Revisions to the active particulate monitoring program will be captured in future updates to the Air Quality and Noise Abatement Management Plan.

The initial dustfall sampling locations and frequency were established at the Mine Site, Milne Port and along the Tote Road in the summer of 2013 to monitor dust deposition rates and verify predictions of its potential impacts (Refer to Attachment 6: Dustfall Monitoring Program for details). In 2018, six (6) new dustfall locations were added within the Tote Road corridor to address commitments made for the Production Increase Proposal (6 MTPA), and monitoring began in 2019 at these locations. A summary of the yearly dustfall sampling program, and results can be found in the Annual Terrestrial Report for the Project. Methodologies used for the program are outlined in Attachment 6: Dustfall Monitoring Program, in addition to the Terrestrial Environment Mitigation and Monitoring Plan. Sampling locations and frequency associated with the Dustfall Monitoring Program will be reassessed and revised as required.

Along with dust monitoring, Baffinland commits to continuous monitoring of SO_2 and NO_x at Milne Port following the start of ore shipments to be carried out through several shipping seasons. Intermittent monitoring at the Mine Site will also be performed. A review for the continuation of these programs based on the results of the monitoring and through consultation with Environment Canada will be performed. To address this commitment, air quality monitoring systems were installed at the Mine Site and Milne Port during late 2014 to monitor SO_2 and NO_x. Baffinland commits to re-visit this monitoring program should the Project change significantly.

Table 8 and Table 9 present an overview of the indicators and corrective action to be taken should thresholds be exceeded.

TABLE 8: AIR QUALITY PERFORMANCE INDICATORS AND THRESHOLD

Location	Indicator	Threshold	Corrective Action
Mine Site	SO_2 NO_2 $PM_{2.5}$ TSP	Refer to Table 5	Review mitigation measures in place. Review specification on equipment. Review maintenance schedule for combustion equipment.
Milne Port	SO_2 NO_2 $PM_{2.5}$ TSP	Refer to Table 5	Review mitigation measures in place. Review specification on equipment. Review maintenance schedule for combustion equipment.

TABLE 9: DUSTFALL PERFORMANCE INDICATORS AND THRESHOLDS

Location	Indicator	Threshold	Corrective Action
Mine Site	Dustfall	4.6 g/m^2/yr	Use of additional or alternative dust suppressant. Review mitigation measures in place. Review specification on equipment. Review maintenance schedule for combustion equipment.
Tote Road	Dustfall	4.6 g/m^2/yr	Use of additional or alternative dust suppressant Speed limit for vehicles
Milne Port	Dustfall	4.6 g/m^2/yr	Use of additional or alternative dust suppressant Review mitigation measures in place. Review specification on equipment. Review maintenance schedule for combustion equipment.

5.2.2 INCINERATOR EMISSION TESTING

Non-hazardous combustible camp waste is disposed of in camp incinerators. Incinerated waste is typically generated from the kitchen and personnel accommodations. All waste sent to the incinerator will be sorted as per the Waste Sorting Guidelines (BAF-PH1-830-P25-0001) described in the Waste Management Plan (BAF-PH1-830-P16-0028). Initial stack tests were conducted upon commissioning all camp incinerators to confirm conformance with all applicable Air Quality regulations based on a 'typical' waste stream. Camp incinerators are currently installed at Milne Port and the Mine Site. Each incinerator uses dual-chamber, variable-airflow design technology and is specifically designed for remote camp operations. The operation of incinerators will be monitored using on-line instruments capable of continuous temperature monitoring of the combustion process in both chambers and stack emissions. Temperature readings outside of the normal range can warn the operator that the system is not working properly. The incinerator computer module is connected to Baffinland's network, and burns can be monitored remotely to assess efficacy and provide real-time improvements to incinerator burns.

Incinerators onsite are capable of meeting the Canadian Council of Ministers of the Environment (CCME), CWS for mercury emissions, and the CCME-CWS for dioxins and furans. The incinerators are operated as required, using the Incinerator Operation Procedure (BAF-PH1-320-PRO-0002) which has been developed in accordance with the manufacturers' recommendations. All incinerator operators receive training by experienced supervisory personnel.

5.2.3 EXPANDED REGIONAL STUDY

As per Term and Condition # 7, once the rail project becomes operational, similar land-based monitoring stations will be installed along Foxe Basin and along Hudson Strait.

The purpose of these land-based stations is to provide an expanded study area to capture emissions related to shipping traffic.

5.3 NOISE

The purpose of the monitoring program is to assess the magnitude of noise impacts from Project activities. The main activities expected to cause noise impacts include mining, crushing, generators, aircraft activities and transportation activities related to ore, overburden, and waste rock.

Field activities will be conducted in accordance with the EPP to minimize potential effects on people and wildlife. More specifically, equipment will be operated with modern mufflers, and subjected to regular maintenance. In remote areas, drilling and other site activities will be guided by the presence and response of wildlife.

Table 10 presents performance indicators, thresholds, and corresponding corrective action. The site management will also need to ensure certification of noise compliance is current, where applicable.

TABLE 10: NOISE PERFORMANCE INDICATORS AND THRESHOLDS

Location	Frequency	Indicator	Threshold	Corrective Action
Mine Site	To be determined	Noise level at fenceline.	40 dBA	Review mitigation measures in place.
Milne Port	To be determined	Noise level at fenceline.	40 dBA	Review mitigation measures in place.

6 REPORTING REQUIREMENTS

6.1 REPORTING

Information collected on air quality and noise via the monitoring programs described in Section 6 will be reported annually to the NIRB as per the Terms and Conditions of the Project Certificate. GHGs will also be reported to Environment Canada as described below in Section 7.1.3.

Specifically, reporting will address:

6.1.1 AIR QUALITY

- Report on incinerator testing (as per requirements of Attachment 2, Table 11 – T&C # 11 and 12)
- Results of active air quality measurements at the Mine Site and Milne Port (Attachment 2, Table 12 commitment # 61)
- Results of dust deposition monitoring at the Mine Site, along Tote Road, and, Milne Port (Attachment 2, Table 12 commitment #60).
- Report on land-based monitoring stations.
- Report on exceedances to FEIS predicted air quality predictions.

In accordance with T&C # 8 (Attachment 2, Table 11), in cases where exceedances are manifested, Baffinland will provide an explanation for the exceedance, a description of planned mitigation, and shall conduct additional monitoring to evaluate the effectiveness of mitigative measures.

6.1.2 NOISE

- Report on noise monitoring at camp sites (Attachment 2, Table 11 T&C #14)

6.1.3 GREENHOUSE GAS

As per the Notice with respect to reporting of greenhouse gases (GHGs) for 2014 (EC, 2014a), if Baffinland meets or exceeds the 50,000 tonnes CO_2 eq threshold, it will be required to report emissions for each of the following gases or groups of gases:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Sulphur hexafluoride (SF_6)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)

Total quantity in tonnes of direct emissions of CO_2, CH_4, and N_2O must be reported for the following source categories:

- Stationary Fuel Combustion
- Venting
- Flaring
- Fugitive
- On-site Transportation
- Waste
- Wastewater

Baffinland will estimate its emissions according to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 2006). These guidelines describe the various approaches to estimate GHG emissions per category.

Additionally, the following will be reported annually to the NIRB as per the Terms and Conditions of the Project Certificate:

- Quantity of fuel consumed during the year
- Calculation of greenhouse gas emissions for the site (Attachment 2, Table 11 T&C # 9)
- Provide interested parties with evidence of continued initiatives undertaken to reduce greenhouse gas emissions (Attachment 2 – Table 11 T&C # 3)
- And estimate of marine shipping vessels emissions (refer to Attachment 2, Table 12 Commitment #62)
- Report on efforts made with shipping partners to reduce fuel consumption (refer to Attachment 2, Table 12 Commitment #63).

6.1.4 METEOROLOGICAL DATA

In accordance with Project Certificate Terms and Conditions and other Baffinland commitments (refer to Attachment 2), the following information will also be made available to regulatory agencies (Environment Canada, NRCan, others):

- Tidal information at Milne Port (Attachment 2, Table 11 T&C #1).
- Weather related information (Attachment 2, Table 11 T&C #5, Table 12 Commitments #58 and 59).

6.2 DOCUMENTATION AND DATA CONTROL

Baffinland's Environmental Manager will oversee the preparation, review, and distribution, as appropriate, of the data and reports required for regulatory purposes.

Execution of some of the monitoring programs detailed in the Air Quality and Noise Abatement Management Plan will be conducted by, or supported by consultants and contractors to Baffinland. Data and reports will be prepared and delivered to Baffinland by its consultants for internal and external distribution and use, as appropriate.

All formalized documents and reports will follow data-control procedures, with revision numbers and revision tracking. Documents and data that are to be issued and liable to change will be controlled to ensure they are approved before issue and that the current issue or revision is known to and available to those requiring them.

6.3 INTERNAL AND EXTERNAL REPORTING

Implementation of monitoring under the Air Quality and Noise Abatement Management Plan results in collection of data and generation of various reports. Whereas there are regulatory requirements for formal monthly and annual reports, including disclosure of issues of non-conformance, internal reporting is used to provide direction to personnel and to provide operational updates to site and corporate management. Internal reporting mechanisms might include environment reports, operations reports, and routine inspection reports. Site-based toolbox and management meetings are also an important internal reporting tool commonly used.

Parks Canada has requested to be provided with regular flight and shipping schedules that can be used to brief visitors to the park. Any changes to the regular schedule that is substantially different will need to be notified to the Parks Canada so that appropriate mitigations can be explored.

7 QUALITY ASSURANCE/QUALITY CONTROL

As per the requirements of Baffinland's EHS Framework (SD-STE-001), regular audits will be undertaken to ensure compliance with the current Air Quality and Noise Abatement Management Plan and that best management practices are implemented. The result of this audit will form the basis for an annual written statement of assurance by management on effectiveness of the Air Quality and Noise Abatement Management Plan.

In terms of the physical sampling, maintenance of sampling station, and analytical services that may be performed by consultants or contractors, Baffinland's procurement procedures for these services will ensure that the consultant or contractor retained to execute the work has the necessary accreditation, calibration and QA/QC procedures in place.

8 ADAPTIVE STRATEGIES

Baffinland is committed to continuous improvement in its work activities in the aim of reducing risks to the environment and improving operational effectiveness. The strategy employed at Baffinland is regular monitoring supported by operational change and adoption of other mitigating measures if warranted.

As per the requirements of Baffinland's HSE Management Framework (SD-STD-001), the company will conduct and document management reviews of its Air Quality and Noise Abatement Management Plan on a regular basis. Such reviews will ensure the integration of monitoring results for the Air Quality and Noise Abatement Management Plan are integrated with other aspects of the Project and that necessary adjustments are implemented as required. These reviews also provide a formal mechanism to assess the effectiveness of the management in achieving the company's objectives and maintaining ongoing compliance with Project permits and authorizations.

9 REFERENCES

1. Alberta Energy and Utilities Board. 2007. *Directive 038: Noise Control*, revised February 16, 2007, www.eub.ca.
2. Baffinland, EIS Volume 5, Atmospheric Environment, December 2010
3. Baffinland, Amended FEIS Volume 5, Atmospheric Environment, June 2013
4. Bender, W.L. 1996. *Report on Estimated Airblast and Blas-Related Vibration at the Lincoln Project, Placer County, California.*
5. Department of Fishers and Oceans. 1998. *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters,* Minister of Public Works and Government Services Canada.
6. Government of Nunavut. 2014. *Environmental Guideline for Dust Suppression on Unpaved Roads.* Department of Environment, Environmental Protection Division.
7. Government of Nunavut. 2003. *Nunavut Climate Change Strategy.* October, 2003.
8. Government of Nunavut. Undated. *Greenhouse Gas Emissions Brochure*, includes Table 1: Annual GHG Emissions from Nunavut Communities (kt CO2e).
9. Environment Canada. 2010a. *Canada's Greenhouse Gas Inventory.* Available at: http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=83A34A7A-1. Last updated June 30, 2010.
10. Environment Canada. 2010b. *National Ambient Air Quality Objectives.*
11. Environment Canada. 2014a. Notice with respect to reporting of greenhouse gases (GHGs) for 2014. Canada Gazette part 1, Vol. 148, No. 41. October 11, 2014. Available at: http://gazette.gc.ca/rp-pr/p1/2014/2014-10-11/pdf/g1-14841.pdf
12. Environment Canada. 2014b. Facility Greenhouse Gas Emissions Reporting: Technical Guidance on Reporting Greenhouse Gas Emissions. October 2014. En81-6/2014E-PDF.
13. Government of the Northwest Territories. 2002. *Guideline for Ambient Air Quality Standards in the Northwest Territories.* Dept. of Resources, Wildlife and Economic Development, Environmental Protection Service.
14. Government of Nunavut. 2011. *Environmental Guideline for Ambient Air Quality.* Department of Environment, Environmental Protection Division.
15. IPCC. 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T., and Tanabe K. (Eds). Published: IGES, Japan.
16. Ontario Ministry of Environment. 2008. *Ontario's Ambient Air Quality Criteria.* Standards and Development Branch. February 2008.

Attachment 1: Sustainable Development Policy

Baffinland Iron Mines Corporation

SUSTAINABLE DEVELOPMENT POLICY

BAF-PH1-800-POL-0002

Rev 1

Approved By: Brian Penney
Title: Chief Executive Officer
Date: March 7, 2016
Signature:

DOCUMENT REVISION RECORD

Issue Date MM/DD/YY	Revision	Prepared By	Approved By	Issue Purpose
05/07/15	0	EM	TP	For Use
03/07/16	1	JS	BP	Minor edits

At Baffinland Iron Mines Corporation (Baffinland), we are committed to conducting all aspects of our business in accordance with the principles of sustainable development & corporate responsibility and always with the needs of future generations in mind. Baffinland conducts its business in accordance with the Universal Declaration of Human Rights and ArcelorMittal's Human Rights Policy which applies to all employees and affiliates globally.

Everything we do is underpinned by our responsibility to protect the environment, to operate safely and fiscally responsibly and with utmost respect for the cultural values and legal rights of Inuit. We expect each and every employee, contractor, and visitor to demonstrate courageous leadership in personally committing to this policy through their actions. The Sustainable Development and Human Rights Policy is communicated to the public, all employees and contractors and it will be reviewed and revised as necessary on a regular basis. These four pillars form the foundation of our corporate responsibility strategy:

1. Health and Safety
2. Environment
3. Upholding Human Rights of Stakeholders
4. Transparent Governance

1.0 HEALTH AND SAFETY

- We strive to achieve the safest workplace for our employees and contractors; free from occupational injury and illness, where everyone goes home safe everyday of their working life. Why? Because our people are our greatest asset. Nothing is as important as their health and safety. Our motto is "Safety First, Always".
- We report, manage and learn from injuries, illnesses and high potential incidents to foster a workplace culture focused on safety and the prevention of incidents.
- We foster and maintain a positive culture of shared responsibility based on participation, behaviour, awareness and promoting active courageous leadership. We allow our employees and contractors the right to stop any work if and when they see something that is not safe.

2.0 ENVIRONMENT

- Baffinland employs a balance of the best scientific and traditional Inuit knowledge to safeguard the environment.
- Baffinland applies the principles of pollution prevention, waste reduction and continuous improvement to minimize ecosystem impacts, and facilitate biodiversity conservation.
- We continuously seek to use energy, raw materials and natural resources more efficiently and effectively. We strive to develop more sustainable practices.
- Baffinland ensures that an effective closure strategy is in place at all stages of project development to ensure reclamation objectives are met.

3.0 UPHOLDING HUMAN RIGHTS OF STAKEHOLDERS

- We respect human rights, the dignity of others and the diversity in our workforce. Baffinland honours and respects the unique cultural values and traditions of Inuit.
- Baffinland does not tolerate discrimination against individuals on the basis of race, colour, gender, religion, political opinion, nationality or social origin, or harassment of individuals freely employed.
- Baffinland contributes to the social, cultural and economic development of sustainable communities in the North Baffin Region.
- We honour our commitments by being sensitive to local needs and priorities through engagement with local communities, governments, employees and the public. We work in active partnership to create a shared understanding of relevant social, economic and environmental issues, and take their views into consideration when making decisions.
- We expect our employees and contractors, as well as community members, to bring human rights concerns to our attention through our external grievance mechanism and internal human resources channels. Baffinland is committed to engaging with our communities of interest on our human rights impacts and to reporting on our performance.

4.0 TRANSPARENT GOVERNANCE

- Baffinland will take steps to understand, evaluate and manage risks on a continuing basis, including those that may impact the environment, employees, contractors, local communities, customers and shareholders.
- Baffinland endeavours to ensure that adequate resources are available and that systems are in place to implement risk-based management systems, including defined standards and objectives for continuous improvement.
- We measure and review performance with respect to our safety, health, environmental, socio-economic commitments and set annual targets and objectives.
- Baffinland conducts all activities in compliance with the highest applicable legal & regulatory requirements and internal standards.
- We strive to employ our shareholder's capital effectively and efficiently and demonstrate honesty and integrity by applying the highest standards of ethical conduct.

4.1 FURTHER INFORMATION

Please refer to the following policies and documents for more information on Baffinland's commitment to operating in an environmentally and socially responsible manner:

Health, Safety and Environment Policy
Workplace Conduct Policy
Inuktitut in the Workplace Policy
Site Access Policy
Hunting and Fishing (Harvesting) Policy
Annual Report to Nunavut Impact Review Board

ArcelorMittal Canada Sustainability and Corporate Responsibility Report

If you have questions about Baffinland's commitment to upholding human rights, please direct them to contact@baffinland.com.

Brian Penney
Chief Executive Officer
March 2016

Attachment 2: Amended Project Certificate Terms and Conditions

Below are Concordance Tables of this management plan with amended NIRB Project Certificate No. 005, May 2014 (main text) and Appendix A to NIRB Decision Report

TABLE 11: CONCORDANCE TABLE WITH NIRB PROJECT CERTIFICATE NO 005 AMENDMENT 1, TERMS & CONDITION

No.	Term and Condition	Comments
Meteorology and Climate (including Climate Change)		
1	The Proponent shall use GPS monitoring or a similar means of monitoring at both Steensby Port and Milne Port, with tidal gauges to monitor the relative sea levels and storm surges at these sites.	A tide gauge is installed annually at Milne Port. Refer to Section 6 for Reporting.
2	The Proponent shall provide the results of any new or revised assessments and studies done to validate and update climate change impact predictions for the Project and the effects of the Project on climate change in the Local Study Area and Regional Study Area as defined in the Proponent's Final Environmental Impact Statement.	Ongoing
3	The Proponent shall provide interested parties with evidence of continued initiatives undertaken to reduce greenhouse gas emissions.	Refer to Section 6 for Reporting
4	The Proponent shall endeavour to include the participation of Inuit from affected communities and other communities in Nunavut when undertaking climate-change related studies and research.	Ongoing
5	The Proponent shall endeavour to explore and implement reasonable measures to ensure that weather-related information for the various Project sites is readily accessible to the public on a continual basis throughout the life of the Project	Refer to Section 6 for Reporting
Air Quality		
6	The Proponent shall provide the results of any emissions calculations conducted to determine the level of sulphur dioxide (SO_2) emissions, nitrogen oxide (NO_X) emissions and greenhouse gases generated by the Project using fuel consumption or other relevant criteria as a basis.	Refer to Section 6 for Reporting.
7	The Proponent shall update its Air Quality and Noise Abatement Management Plan to provide for continuous monitoring at land-based monitoring stations designed to capture operations phase ship-generated SO2 and NO2 emissions at Steensby Port and Milne Port. Continuous monitoring is to be carried out through several shipping	Refer to Section 5 for Monitoring and Section 6 for Reporting

No.	Term and Condition	Comments
	seasons at each port as required to determine that emissions are at acceptable levels.	
8	The Proponent shall demonstrate through monitoring of air quality at the mine site and at the Steensby Inlet and Milne Inlet port sites that SO_2 and NO_2 emissions remain within predicted levels and, where applicable, within limits established by all applicable guidelines and regulations. In cases where exceedances are manifested, the Proponent shall provide an explanation for the exceedance, a description of planned mitigation, and shall conduct additional monitoring to evaluate the effectiveness of mitigative measures.	Refer to Section 5 for Monitoring and Section 6 for Reporting.
9	The Proponent shall provide calculations of greenhouse gas emissions generated by activities at the Steensby Inlet and Milne Inlet port sites and other Project sources including aircraft associated with the Project. Calculations shall take into consideration, fuel consumption as measured by Baffinland's purchase and use as well as the fuel use of its contractors and sub-contractors.	Refer to Section 6 for Reporting.
10	9.1.1.1 The Proponent shall update its Dust Management and Monitoring Plan to address and/or include the following additional items: 9.1.1.2 a) Outline the specific plans for monitoring dust along the first few kilometres of the rail corridor leaving the Mary River mine site. 9.1.1.3 b) Identify the specific adaptive management measures to be considered should monitoring indicate that dust deposition from trains transporting along the rail route is greater than initially predicted. 9.1.1.4 c) Outline specific plans for monitoring dustfall at intervals along and in the vicinity of the Milne Inlet Tote Road to determine the amount and extent of dustfall. 9.1.1.5 d) Identify the specific adaptive management measures to be considered if monitoring indicates that dust deposition from traffic on the Milne Inlet Tote Road is greater than initially predicted.	Section 3 presents Mitigation measures Section 5 presents Monitoring Section 6 presents Reporting Refer to attachment 6 for additional information
11	The Proponent shall develop and implement an Incineration Management Plan that takes into consideration the recommendations provided in Environment Canada's Technical Document for Batch Waste Incineration (2010).	Refer to Section 6
12	Prior to commencing any incineration of on-site Project wastes, the Proponent shall conduct at least one stack test immediately following the commissioning of each	Refer to Section 6

No.	Term and Condition	Comments
	temporary and permanent incinerator.	
Noise and Vibration		
13	The Proponent is encouraged to work with Fisheries and Oceans Canada at the regulatory phase and to take a precautionary approach when selecting the overpressure threshold to be applied to explosives use for the protection of fish and aquatic life.	Refer to the Blasting Management Plan (Type A Water Licence). This plan was developed in consultation with the DFO. Refer to Section 4.9
14	The Proponent shall conduct noise and vibration monitoring at project accommodations sites located at the Mary River Mine Site, Steensby Inlet Port Site and Milne Inlet Port Site. Sampling shall be undertaken during the summer and winter months during all phases of Project development.	Refer to Section 5
14(a)	The Proponent, through coordination with the MEWG as may be appropriate, shall demonstrate appropriate adaptive management for construction activities at Milne Inlet that have the potential to disrupt marine mammal species, including pile driving and ore dock construction, are undertaken.	Refer to the Shipping and Marine Wildlife Management Plan
14(b)	The Proponent, through coordination with the TEWG as may be appropriate, shall demonstrate appropriate adaptive management for project activities during operations which have the potential to produce noise and sensory disturbance to wildlife and other users of project areas.	This condition is in progress in consultation with the Terrestrial Environment Working Group (TEWG).
15	The Proponent shall collaborate to the extent possible with the Qikiqtani Inuit Association and local Hamlet organizations when undertaking consultation with all affected communities regarding railway, tote road and marine shipping operations. During these consultations, it is recommended that the Proponent provide information including video, audio, and photographic representation as well as any other aids (i.e. models) that may enhance the general public's understanding of railway, tote road and marine shipping operations, as well as all safety considerations for members of the public who may be travelling around the project area.	Baffinland continues to work with Hamlet and QIA regarding safety considerations for travel and interaction with project for those travelling in the area. In support of this, Baffinland established the Pond Inlet Community Advisory Group (which includes HTO and Hamlet representation) and continues to work with the Marine and Terrestrial working groups, of which QIA is a member.

TABLE 12: APPENDIX A TO NIRB DECISION REPORT

No.	Subject	Commitment	Action
2	Design (Fugitive Dust)	Baffinland is committed to developing and implementing mitigation measures, which control fugitive dust emissions.	Refer to Section 3 of this Management Plan
3	Operations (Ore Processing and Tailings)	Baffinland will undertake only the physical crushing and screening processing of the ore generated from the Mary River Project within the project area.	Crushing and screening is limited to the Mine Site.
18	Railway (Locomotives)	Baffinland is committed to purchasing the highest tier (per the USA's EPA standards) of locomotive available for use at the Mary River project.	Deferred until approved Project gets under way
32	Marine (Noise)	Baffinland is committed to providing the QIA with a copy of the frequency-noise distribution graph for sound generated by ore ship propellers travelling through ice.	Addressed in Shipping and Marine Mammals Management Plan
40	Monitoring (Abandonment and Restoration)	Baffinland is committed to undertaking environmental effects monitoring during the mine life mine as well as after closure.	Addressed in Abandonment and Reclamation Plan
57	Management Plans	Baffinland is committed to updating its management plans to reflect new information, new practices and changes to operating conditions.	Refer to page 1 for date of update. Refer to Section 9 for commitment to Adaptive Strategies
58	Meteorology and Climate (Reporting)	Baffinland is committed to contributing to regional monitoring and information gathering.	Refer to Section 7 - Reporting
59	Meteorology and Climate (Reporting)	Baffinland is committed to giving consideration to the sharing of weather data collected for the Mary River Project with Environment Canada to post on its public weather network.	Refer to Section 7 - Reporting
60	Air Quality (Fugitive Dust from Railway Shipping)	Baffinland is committed to monitoring fugitive dust emissions on vegetation along the first few kilometres of the Railway leaving both terminals (Mary River and Steensby Inlet). This monitoring will be extended if it is identified that other areas of the project site are also being impacted by fugitive dust emissions.	Refer to Section 6 of this Plan – this commitment is applied to dust monitoring along the Tote Road Attachment 6 of this plan.
61	Air Quality (SO_2 Emissions)	Baffinland is committed to conducting passive monitoring of SO_2 at the Steensby Inlet camp.	Refer to Section 6 of this Plan – this commitment is applied to passive monitoring at Milne Port.

No.	Subject	Commitment	Action
62	Project Design (Marine Shipping Air Emissions)	Baffinland is committed to estimating marine shipping vessel emissions associated with the Mary River Project.	Refer to Section 7 for reporting
63	Project Design (Greenhouse Gas)	Baffinland and its shipping partners are committed to working with shipyards to reduce fuel consumption by 20% or more.	Refer to Section 7 for reporting
66	Monitoring	Baffinland is committed to the development and implementation of a monitoring program during the construction and other phases of the Mary River Project.	This management plan addressed the air quality and noise components.

TABLE 13: RESOLUTIONS AND COMMITMENTS FOR THE PRODUCTION INCREASE PROPOSAL (6 MTPA APPLICATION)

No.	Subject	Commitment	Action
11	Dust	Confirmation is required from Baffinland on the extent of additional monitoring that will be implemented along the Tote Road to assess the impact of increased project activities associated with the 6Mtpa application.	Refer to Attachment 6 of this Management Plan
12	Dust	Confirmation is required from Baffinland on measures that will be implemented to effectively manage dust generated along the Tote Road due to current and increased project activities.	Refer to Section 3 of this Management Plan
14	Management Plans	Commitment is required from Baffinland on whether it will be updating its Management Plans to reflect changes in project scope and operational requirements.	Refer to Attachment 6 of this Management Plan

Attachment 3: Baseline Project Conditions

TABLE 1: MEASURED CONATAINMENT CONCENTRATIONS FOR THE MARY RIVER PROJECT

Parameter	Baseline Concentration ($\mu g/m^3$)
24-hour TSP	7.0
24-hour PM_{10}	3.8
30-day SO_2	0.262
30-day NO_2	0.188
30-day O_3	52.8

TABLE 2: BASELINE DUSTFALL DEPOSITION RATES

Parameter	Baseline Deposition Rate ($\mu g/100cm^2$/30-days)
Total Dustfall	0.398

TABLE 3: BASELINE METAL DEPOSITION RATES FOR SELECTED METALS

Parameter	Baseline Deposition Rate ($\mu g/100cm^2$/30-days)
Al	26.9
Co	0.5
Cr	0.3
Fe	30.6
Mg	23.9
Mn	1.7

Data obtained from the 2007 sampling program were compared with federal and other provincial air quality criteria (see Section 1.2) and with data from other air quality monitoring stations in the Canadian Arctic. Results are shown in Table 4 Baseline Ambient Air Quality Monitoring Results, and indicate that concentrations of both TSP and PM_{10} were well below applicable indicator thresholds.

TABLE 4: BASELINE AMBIENT AIR QUALITY MONITORING RESULTS

Air Quality Parameter	24-h Indicator Threshold	Mary River Sampling Locations			
		1A	1B	2A	2B
Maximum TSP (µg/m³)[1]	120	3.5	3.0	**7.0**	5.5
Maximum 24-h PM_{10}, (µg/m³)[2]	50	3.0	1.5	1.8	**3.8**
Total dustfall deposition rate (30-day average) (µg/100cm²/30d) [3]					
SO_2 (30-day average) (µg/m³)[3]	450 (1-h) 150 (24-h) 30 (annual)				
NO_2 (30-day average) (µg/m³)[3]	400 (1-h) 200 (24-h) 60 (annual)				
O_3 (30-day average) (µg/m³)[3]	100 (1-h) 127 (8-h) 30 (24-h) 30 (annual)				
Metal deposition rates (30-day average) µg/100cm²/30d (3)					

NOTES:
[1] – based on 15 samples
[2] – based on 12 days of sampling
[3] – based on 50 days of sampling.
Bold values indicate maximum values selected as baseline concentrations.

TABLE 5: BASELINE AMBIENT NOISE MONITORING RESULTS

Site	Leq (24 h) (dBA)	Leq (Day, 15 h) (dBA)	Leq (Night, 9 h) (dBA)	Minimum Leq (1 h) (dBA)	Maximum Leq (1 h)(dBA)
Mary River	25	25	26	20	34
Milne Inlet	30	31	29	21	35
Steensby Inlet	29	31	26	23	35

Attachment 4: Weather Stations at Project Sites

Baffinland Iron Mines Corporation Annual Report

2015 Met Station Monitoring and Maintenance

Presented to:

Trevor Meyer
Baffinland Iron Mines Corporation
December 10, 2015

Prepared by:

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Overview

New meteorological stations were installed at Mary River, Milne and Steensby locations on Baffin Island, NU in August 2013 by Campbell Scientific Canada (CSC). These met stations were intended to replace existing Symboticware met stations that were previously installed and had become non-functional. The CSC stations contain new, calibrated rugged sensors and dataloggers in order to provide consistent, accurate and reliable data. These features are particularly important given the remote locations of these stations, where access is a challenge. Some existing hardware, such as enclosures, towers, and power supplies have been repurposed for use with these stations.

Campbell Scientific is also providing both Field and Data Services for all three stations, which include active network and data management.

Field Services includes an annual maintenance trip by a CSC technician. This trip involves field calibrating or swapping of sensors to minimize station downtime, general station maintenance and inspection, and addressing any hardware and/or troubleshooting concerns.

Data Services includes the remote collection of data once a week using each of the stations iridium satellite communications hardware. The data is collected to a CSC server and synced to an FTP site which is accessible by Baffinland Iron Mine Inc. Basic QA/QC is performed on the data in order to monitor station health and identify any abnormalities with a specific parameter/sensor.

This report includes an outline of the work completed by CSC Technician, Travis Holder, during the September 2015 maintenance trip. A summary is also included of the station health and data overview from each station since completion of the 2014 maintenance trip until the date of the maintenance trip in September 2015.

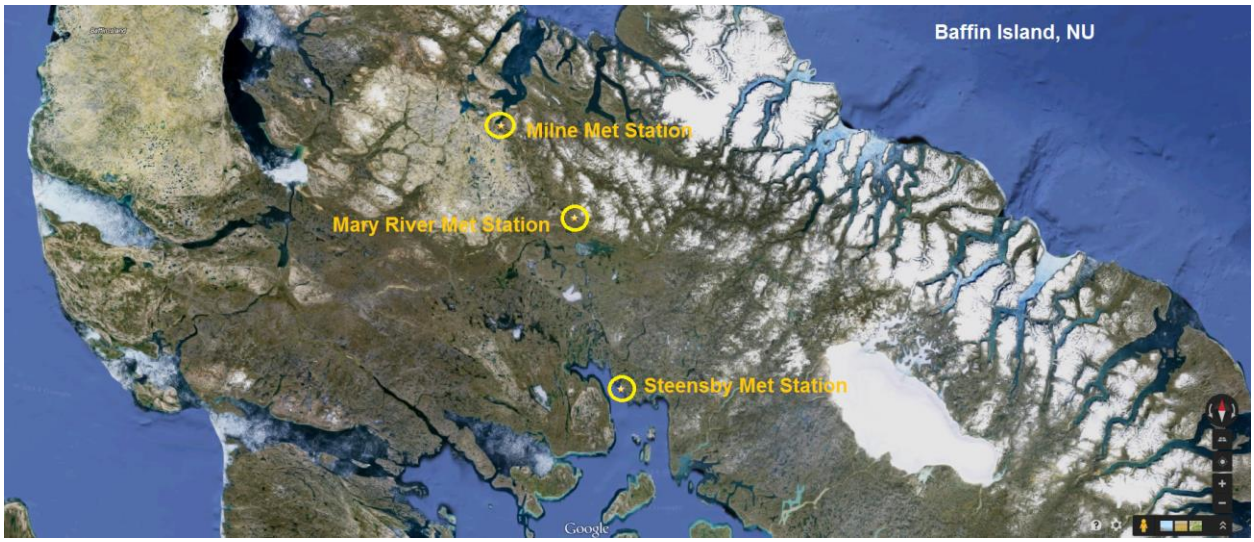


Figure 1: Map of Baffinland met stations installed on Baffin Island, NU as of August 2013

Station Health

Campbell Scientific Canada has been collecting data from the Milne, Mary River and Steensby met stations starting as of late August 2013. The data is collected remotely to a CSC server on a weekly schedule via iridium communication hardware. Once data is collected, it is then synced in near real time to a password protected, secure FTP site accessible by Baffinland end users.

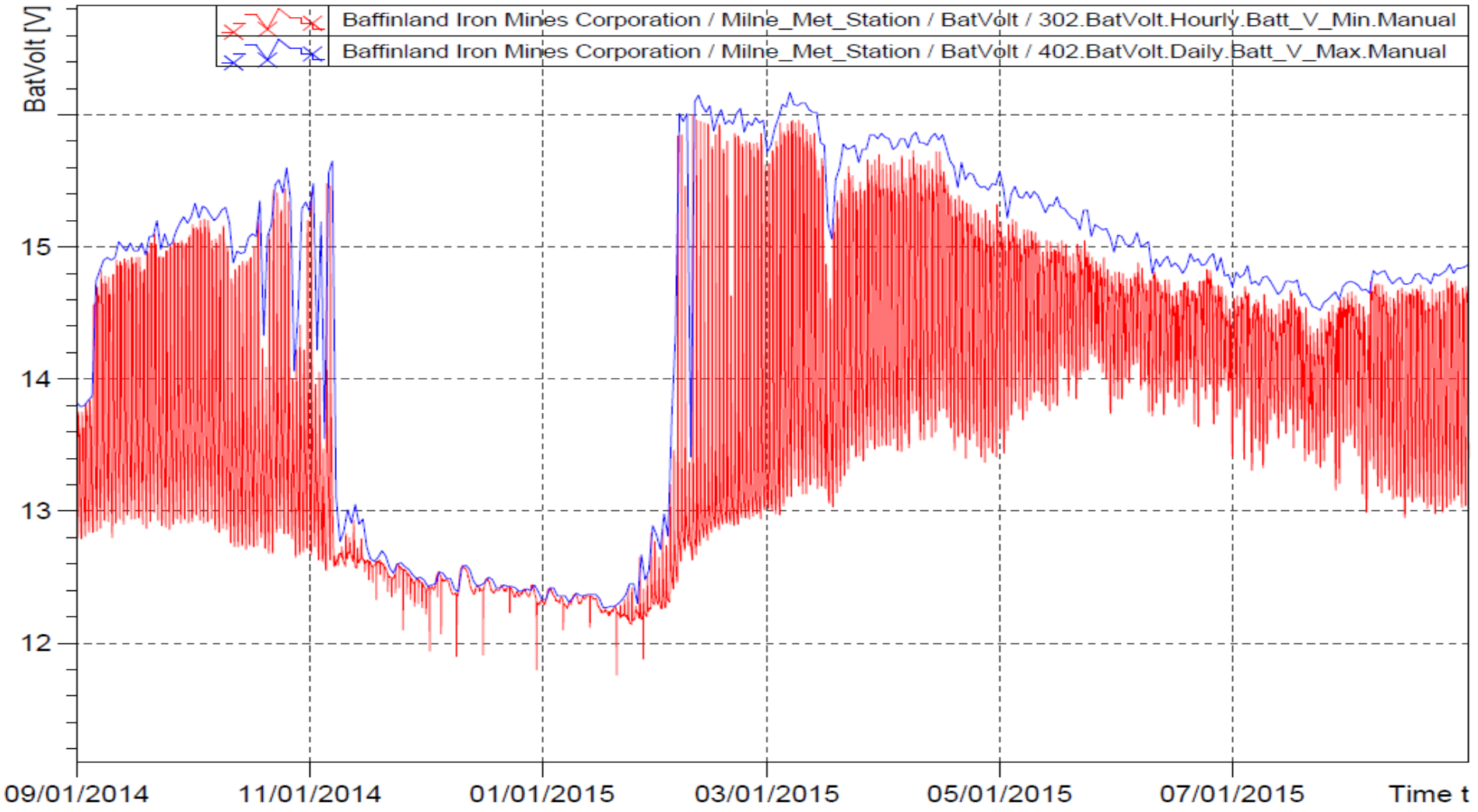
Data QA/QC

A basic QA/QC check of all data is performed in order to monitor station health and flag any suspect or invalid data. All data from each station is being imported into our WISKI database which provides automated data QA/QC and validation. The automated QA/QC occurs within several minutes after data is collected from each station and imported into the WISKI database. Below are events that occurred and were flagged during the past year:

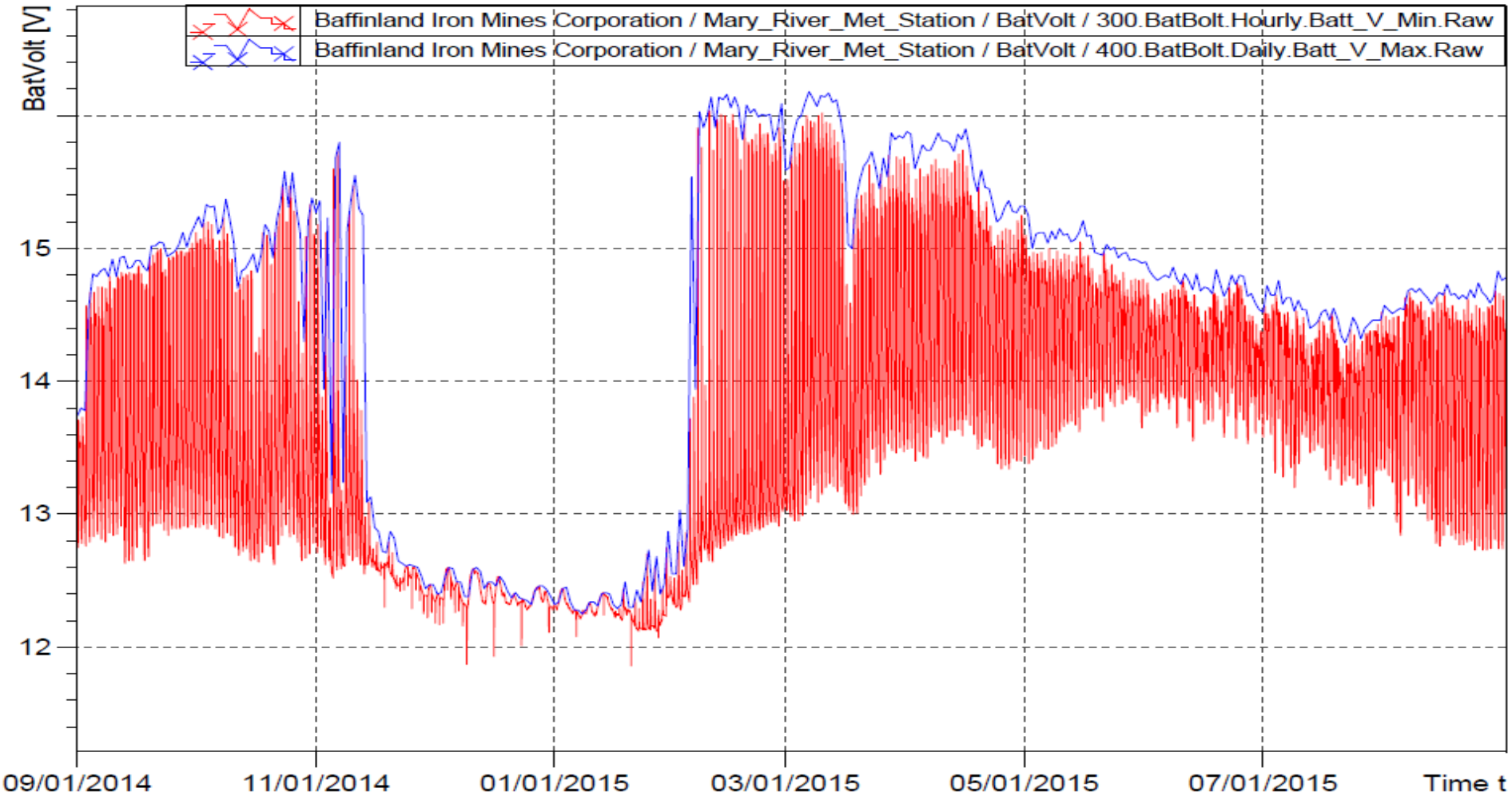
The removed HC-S3-XT Temp/RH probe heads (previously installed during 2014 maintenance trip) from the Milne, Mary River and Steensby met stations were returned to CSC facility and evaluated by a CSC repair technician. Upon evaluation it was determined that all three probe head temperature sensors were out of specification and could not be properly calibrated. We cannot determine at what point the temperature readings went out of spec over 2014, but can confirm the temperature readings may have been inaccurate by 0.4 or 0.5 degrees during all or a portion of the year, from September 2014 when the sensors were installed to September 2015 when these probe heads were removed. These returned sensors have been replaced under warranty and the replacement sensors were returned to CSC exchange inventory.

Data Retrieval

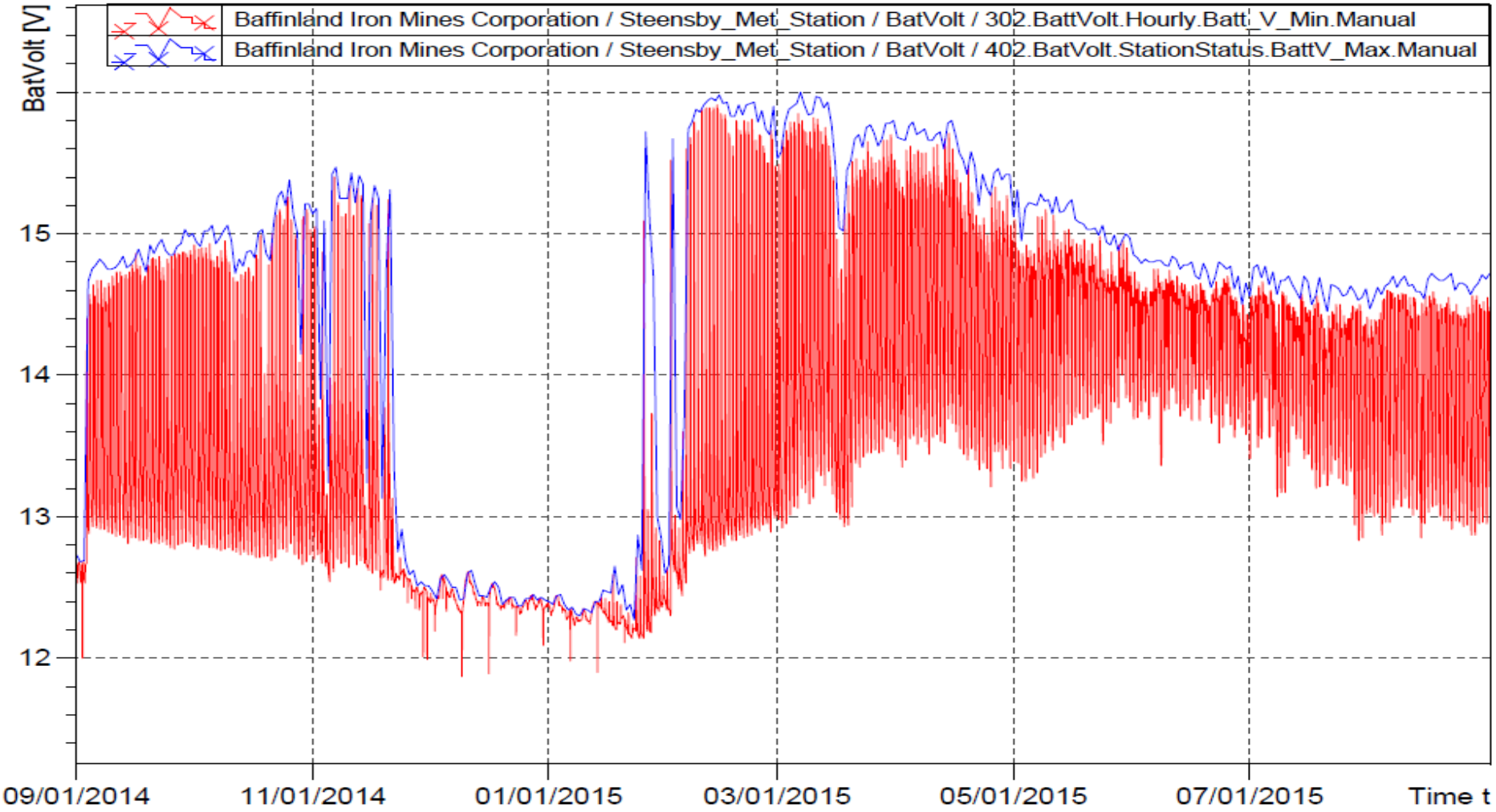
The extra modem power-on windows programmed for each station were turned off remotely by CSC over winter months to conserve battery power. The extra windows were then turned on again remotely in spring. All three stations remained operational over the entire year. A complete set of data files for all station tables has been collected and is stored on the CSC server as well as synced to the FTP folders for each station. Aside from minor station down time which occurred during the 2015 maintenance trip performed by CSC in September 2015, there were no other recorded data gaps over the year from the three met stations.



Graph 1: Milne station power – Sept 2014 to Sept 2015



Graph 2: Mary River station power – Sept 2014 to Sept 2015



Graph 3: Steensby station power – Sept 2014 to Sept 2015

Station Details and Maintenance Summaries

Milne Met Station

71°52'38.9"N 80°49'55.4"W

The Milne weather station equipment was installed by CSC Technician, Mike Ryder, in August 2013. This station is using an existing power supply from the Symboticware met station previously installed at this location. Below is the list of equipment currently installed at this station:

Datalogger:

CR1000 -55 - s/n 56192

Power Supply:

2 X 85 W solar panels

12V 115 AHr Battery

CH100 charger/regulator

Communications:

9522B Iridium satellite modem - s/n 300025010034330

COM9522B Satellite modem interface – s/n 1031

SC932A CS I/O to 9 Pin RS-232 DCE Interface (with L10873 and SC12 cables)

Sensors:

HC-S3-XT Rotronics Temp/RH probe – s/n 61468632

05108 RM Young Wind Monitor – s/n 1278320

SP Lite2 Kipp&Zonen Solar radiation sensor – s/n140745

TE525M Texas Electronics Tipping Bucket Rain Gauge – s/n 56724-8013

Housing:

ENC 16/18 fiberglass waterproof enclosure (datalogger, iridium modem hardware, and charger/regulator)

ENC BATT (12V 115 AHr battery)

Mounting Structure:

UT30 Universal Towers 10M tower with guy wire kit

Milne Maintenance Summary

Site Visit Date – Sept 21, 2015 CSC Technician: Travis Holder

Datalogger:

Prior to any maintenance performed at this station, all existing data stored on the datalogger was downloaded. Due to the age of this CR1000 datalogger calibration was not required. The datalogger lithium battery was recorded at 3.37 Volts, which indicates an acceptable voltage. The lithium battery requires replacement when reading 2.9 Volts or lower.

Chicken wire had been installed at this station during the 2014 maintenance trip to help prevent animals chewing on and damaging exposed cables; however only a small amount of chicken wire had remained at the station over time. During this trip additional chicken wire supplied by CSC was added and wrapped around the bottom of the tower base at this station.

A revised program was uploaded to the station datalogger which included updated modem registration code and included the specified sensitivity value (69.5) for the replacement solar radiation sensor.

Enclosure desiccant and humidity indicator card were replaced and the enclosure port was re-sealed with the existing putty prior to leaving site.

Power Supply:

The station power supply remained healthy over the past year as shown in graph 1 on page 4. Voltage issues look to have been resolved with replacement of charger/regulator at this station during the 2014 maintenance trip. The SunSaver20 regulator remains installed at this station. The battery voltage was recorded at 14.81 Volts while on-site.

Sensors:

A functional test and visual inspection were performed on each sensor. Most real time data values were verified using an on-site handheld unit. The station public table was also collected to verify proper functionality of all sensors. Below is a breakdown of maintenance performed on each sensor:

Temp/RH - The existing HC-S3-XT Temp/RH probe head from this station was exchanged for a refurbished, calibrated replacement HC-S3-XT Temp/RH probe head (s/n 61468632) through the CSC exchange program. The existing station HC-S3-XT probe head was returned to CSC facility for standard maintenance and calibration and then placed into CSC exchange inventory.

Precipitation - The existing TE525M tipping bucket rain gauge from this station was exchanged for a refurbished, calibrated replacement TE525M (s/n 56724-8013) through the CSC exchange program. The existing station TE525M rain gauge was returned to CSC facility for standard maintenance and calibration and then placed into CSC exchange inventory. The funnel screen was missing and replaced as well.

A new mounting bracket was also included with the replacement TE525M. The broken bracket was removed along with the existing TE525M. The funnel of the replacement TE525M was secured to the bucket using electrical tape once installed.

The existing TBRG cable has bare wires, and wraps around screws on the internal terminal strip of bucket. The bare leads were stripped back and doubled over a few times so thick enough to secure under screw on replacement bucket terminal strip. The funnel of the replacement TE525M was secured to the bucket using electrical tape once installed.

Wind Speed/Direction - The 05108-10 wind monitor contains long lasting ceramic bearings to reduce maintenance requirements of this sensor. Therefore calibration/maintenance was not required for this sensor during this site visit. The wind monitor housing and cable were visually inspected and confirmed to be in excellent condition.

Solar Radiation – The 015 mounting arm was removed and the existing SPLite2 solar radiation sensor from this station was exchanged for a refurbished, calibrated replacement SPLite2 solar radiation sensor (s/n140745) through the CSC exchange program. The existing station SPLite2 sensor was returned to CSC facility for standard maintenance and calibration and then placed into CSC exchange inventory. The replacement SP Lite2 sensor level was not specifically confirmed due safety concerns accessing this sensor once the mounting arm was re-installed.

Communications:

A successful remote iridium communications test was performed by CSC Data Services representative once station maintenance was completed prior to leaving site. The communications remains on the existing power control schedule, turning on once a week.

Figure 2: Milne met station (photo taken during 2014 trip -looking towards the West)

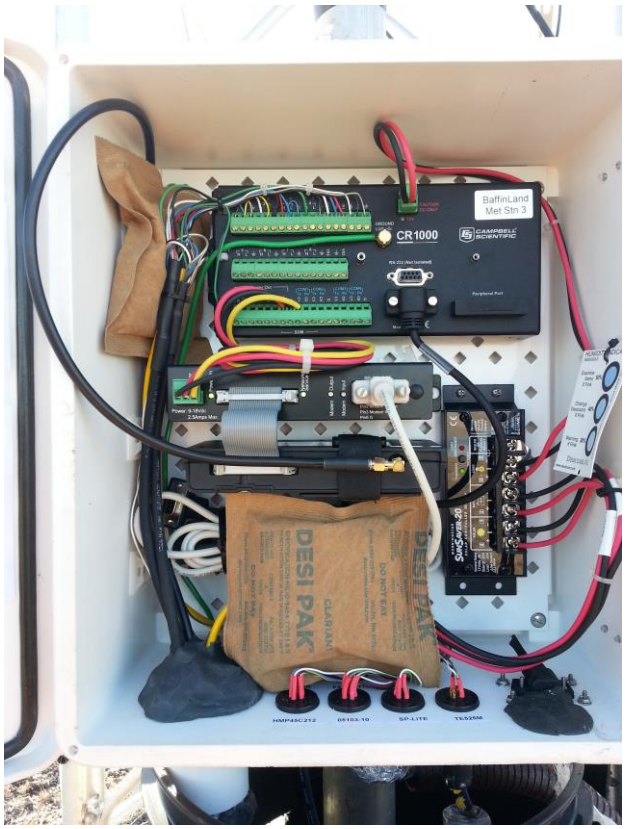


Figure 3: Inside Milne station enclosure (photo taken during 2014 trip)

Figure 4: Supplementary chicken wire added to base of Milne station during 2015 maintenance trip

Mary River Met Station

71°19'27.4"N 79°22'27.5"W

The Mary River weather station equipment was installed by Campbell Scientific Canada Technician, Mike Ryder, in August 2013. This station is using an existing power supply from the Symboticware met station previously installed at this location. Below is the list of equipment currently installed at this station:

Datalogger:

CR1000 -55 - s/n 56190

Power Supply:

2 X 85 W solar panels

12V 115 AHr Battery

CH100 charger/regulator

Communications:

9522B Iridium satellite modem - s/n 300025010334310

COM9522B Satellite modem interface – s/n 1029

SC932A CS I/O interface (with L10873 and SC12 cables)

Sensors:

HC-S3-XT Rotronics Temp/RH probe – s/n 61468628

05108 RM Young Wind Monitor – s/n 1278318

SP Lite2 Kipp&Zonen Solar radiation sensor – s/n 140746

TE525M Texas Electronics Tipping Bucket Rain Gauge – s/n 41626-207

Housing:

ENC 16/18 fiberglass waterproof enclosure (datalogger, iridium modem hardware, and charger/regulator)

ENC BATT (12V 115 AHr battery)

Mounting Structure:

UT30 Universal Towers 10M tower with guy wire kit

Mary River Maintenance Summary

Site Visit Date – Sept 19, 2015 CSC Technician: Travis Holder

Datalogger:

Prior to any maintenance performed at this station, all existing data stored on the datalogger was downloaded. Due to the age of this CR1000 datalogger calibration was not required. The datalogger lithium battery was recorded at 3.36 Volts, which indicates an acceptable voltage. The lithium battery requires replacement when reading 2.9 Volts or lower.

A revised program was uploaded to the station datalogger which included updated modem registration code and included the specified sensitivity value (67.9) for the replacement solar radiation sensor.

Enclosure desiccant was replaced and the enclosure port was re-sealed with the existing putty prior to leaving site.

Power Supply:

The station power supply remained healthy over the past year as shown in graph 2 on page 5. Voltage issues look to have been resolved with replacement of charger/regulator at this station during the 2014 maintenance trip. The SunSaver20 regulator remains installed at this station. The battery voltage was recorded at 14.69 Volts while on-site.

Sensors:

A functional test and visual inspection were performed on each sensor. Most real time data values were verified using an on-site handheld unit. The station public table was also collected to verify proper functionality of all sensors. Below is a breakdown of maintenance performed on each sensor:

Temp/RH - The existing HC-S3-XT Temp/RH probe head from this station was exchanged for a refurbished, calibrated replacement HC-S3-XT Temp/RH probe head (s/n 61468628) through the CSC exchange program. The existing station HC-S3-XT probe head was returned to CSC facility for standard maintenance and calibration and then placed into CSC exchange inventory

Precipitation - The existing TE525M tipping bucket rain gauge from this station was exchanged for a refurbished, calibrated replacement TE525M (s/n 41626-207) through the CSC exchange program. The existing station TE525M rain gauge was returned to CSC facility for standard maintenance and calibration and then placed into CSC exchange inventory.

Wind Speed/Direction - The 05108-10 wind monitor contains long lasting ceramic bearings to reduce maintenance requirements of this sensor. Therefore calibration/maintenance was not required for this sensor during this site visit. The wind monitor housing and cable were visually inspected and confirmed to be in excellent condition.

Solar Radiation – The 015 mounting arm was removed and the existing SPLite2 solar radiation sensor from this station was exchanged for a refurbished, calibrated replacement SPLite2 solar radiation sensor (s/n140746) through the CSC exchange program. The existing station SPLite2 sensor was returned to CSC facility for standard maintenance and calibration and then placed into CSC exchange inventory. The replacement SP Lite2 sensor level was not specifically confirmed due safety concerns accessing this sensor once the mounting arm was re-installed.

While removing the 015 mount for replacing the solar sensors, the mount u-bolt was snapped off due to seizing of the nuts as a result of exposure to extreme elements. A spare compatible u-bolt was not available so a square shaped u-bolt was bent to accommodate re-installation of the 015 solar sensor mounting arm. Currently the top U-bolt for this mount is using 9/16" size nuts and the bottom is using ½" size nuts. The 015 mounting arm was installed and levelled as best as possible without the ability to use a proper levelling tool. The SP Lite2 sensor level was not specifically confirmed due safety concerns accessing this sensor once the mounting arm was re-installed.

Communications:

A successful remote iridium communications test was performed by CSC Data Services representative once station maintenance was completed prior to leaving site. The communications remains on the existing power control schedule, turning on once a week.

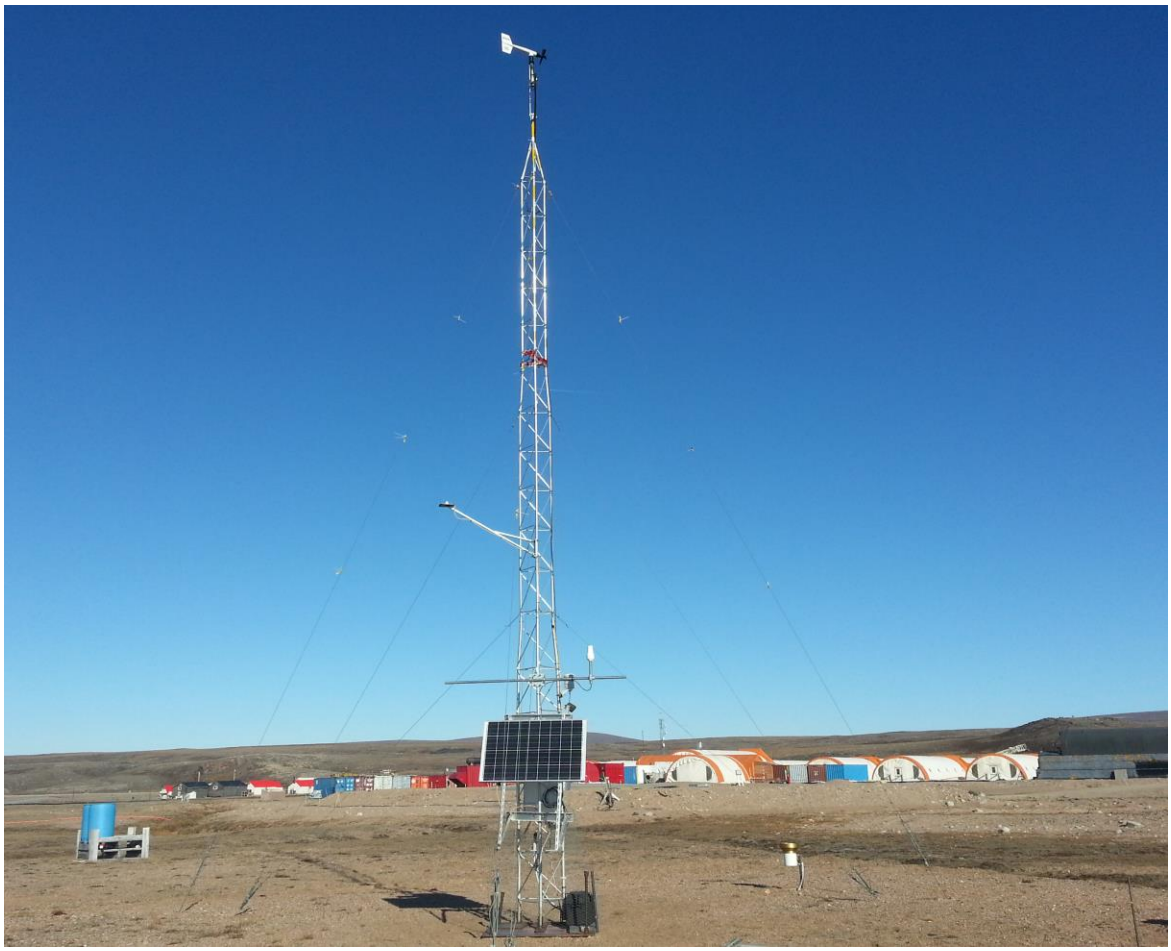


Figure 5: Mary River met station (photo taken during 2014 trip - looking towards the North)

Figure 6: Mary River met station (photo taken during 2015 trip - looking towards the South)

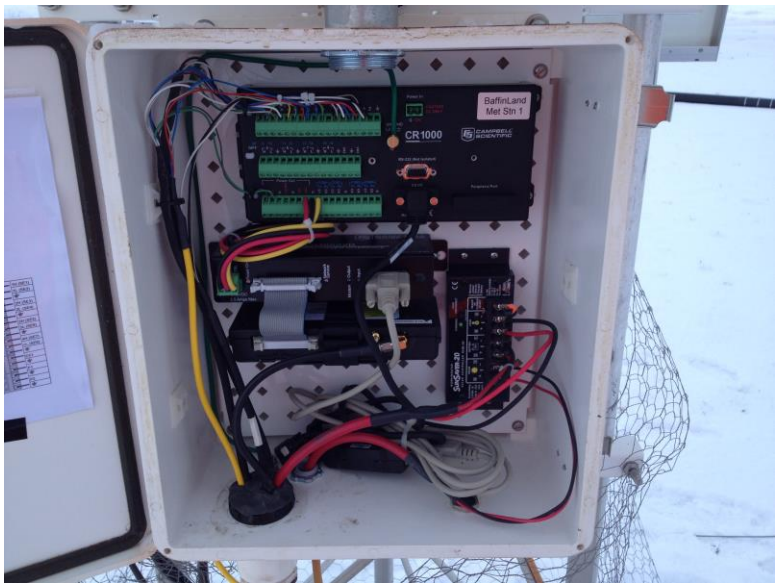


Figure 7: Inside Mary River datalogger enclosure during 2015 maintenance trip

Steensby Met Station

70°16'36.4"N 78°31'37.4"W

The Steensby weather station equipment was installed by Campbell Scientific Canada Technician, Mike Ryder, in August 2013. This station is using an existing power supply from the Symboticware met station previously installed at this location. Below is the list of equipment currently installed at this station:

Datalogger:

CR1000 -55 - s/n 56191

Power Supply:

2 X 85 W solar panels

12V 115 AHr Battery

CH100 charger/regulator

Communications:

9522B Iridium satellite modem - s/n 300025010037320

COM9522B Satellite modem interface – s/n 1030

SC932A CS I/O to 9 Pin RS-232 DCE Interface (with L10873 and SC12 cables)

Sensors:

HC-S3-XT Rotronics Temp/RH probe – s/n 61468626

05108 RM Young Wind Monitor – s/n 1278319

SP Lite2 Kipp&Zonen Solar radiation sensor – s/n 151088

TE525M Texas Electronics Tipping Bucket Rain Gauge – s/n 56721-813

Housing:

ENC 16/18 Fiberglass waterproof enclosure (datalogger, iridium modem hardware, and charger/regulator)

ENC BATT (12V 115 AHr battery)

Mounting Structure:

UT30 Universal Towers 10M tower with guy wire kit

Steensby Maintenance Summary

Site Visit Date – Sept 21, 2015 CSC Technician: Travis Holder

Datalogger:

Prior to any maintenance performed at this station, all existing data stored on the datalogger was downloaded. Due to the age of this CR1000 datalogger calibration was not required. The datalogger lithium battery was recorded at 3.35 Volts, which indicates an acceptable voltage. The lithium battery requires replacement when reading 2.9 Volts or lower.

A revised program was uploaded to the station datalogger which included updated modem registration code and included the specified sensitivity value (72.4) for the replacement solar radiation sensor.

Enclosure desiccant was replaced and the enclosure port was re-sealed the existing putty prior to leaving site.

Power Supply:

The station power supply remained healthy over the past year as shown in graph 3 on page 6. Voltage issues look to have been resolved with replacement of charger/regulator at this station during the 2014 maintenance trip. The SunSaver20 regulator remains installed at this station. The battery voltage was recorded at 14.56 Volts while on-site.

A new battery enclosure was installed to replace the existing cracked enclosure.

Sensors:

A functional test and visual inspection were performed on each sensor. Most real time data values were verified using an on-site handheld unit. The station public table was also collected to verify proper functionality of all sensors. Below is a breakdown of maintenance performed on each sensor:

Temp/RH - The existing HC-S3-XT Temp/RH probe head from this station was exchanged for a refurbished, calibrated replacement HC-S3-XT Temp/RH probe head (s/n 61468626) through the CSC exchange program. The existing station HC-S3-XT probe head was returned to CSC facility for standard maintenance and calibration and then placed into CSC exchange inventory.

Precipitation - The existing TE525M tipping bucket rain gauge from this station was exchanged for a refurbished, calibrated replacement TE525M (s/n 56721-813) through the CSC exchange program. The existing station TE525M rain gauge was returned to CSC facility for standard maintenance and calibration and then placed into CSC exchange inventory. The funnel of the replacement TE525M was secured to the bucket using electrical tape once installed.

Wind Speed/Direction - The 05108-10 wind monitor contains long lasting ceramic bearings to reduce maintenance requirements of this sensor. Therefore calibration/maintenance was not required for this sensor during this site visit. The wind monitor housing and cable were visually inspected and confirmed to be in excellent condition.

Solar Radiation – The 015 mounting arm was removed and the existing SPLite2 solar radiation sensor from this station was exchanged for a refurbished, calibrated replacement SPLite2 solar radiation sensor (s/n 151088) through the CSC exchange program. The existing station SPLite2 sensor was returned to CSC facility for standard maintenance and calibration and then placed into CSC exchange inventory. The replacement SP Lite2 sensor level was not specifically confirmed due safety concerns accessing this sensor once the mounting arm was re-installed.

Communications:

A successful remote iridium communications test was performed by CSC Data Services representative once station maintenance was completed prior to leaving site. The communications remains on the existing power control schedule, turning on once a week.

Figure 8: Steensby met station (picture taken during 2014 trip - looking towards the West)

Figure 9: Inside Steensby datalogger enclosure during 2015 maintenance trip

Figure 10: Previous Steensby cracked battery enclosure

Figure 11: New replacement battery enclosure

Milne Camp

The Milne Camp weather station equipment was installed by Campbell Scientific Canada Technician, Mike Ryder, in September 2014. Below is the list of equipment currently installed at this station:

Datalogger:

CR800

Power Supply:

PS100-8.5 Charger/regulator with rechargeable lead acid 12V battery

Z3749-ND – 120 to 24 VDC AC Adapter (Compatible for use with the WS600-UMB sensor)

Communications:

NL201-XT Ethernet interface – IP Address 10.40.2.17

Sensors:

WS600-UMB Lufft all-in-one smart weather sensor – includes Air Temp,RH, Barometric Pressure, Wind Speed/Direction and Precipitation.

Housing:

ENC 12/14 fiberglass waterproof enclosure (datalogger, Ethernet interface, and charger/regulator)

Mounting Structure:

Enclosure wall mounted inside on-site server room. WS600-UMB sensor mounted on top of user supplied pipe attached to outside of server room canister wall.

Milne Camp Station Maintenance Summary

Due to weather and other delays, CSC was not able to visit this station during this trip.

Figure 12: Milne camp WS600-UMB sensor installed on the outside wall of server room trailer (photo taken from 2014 trip)

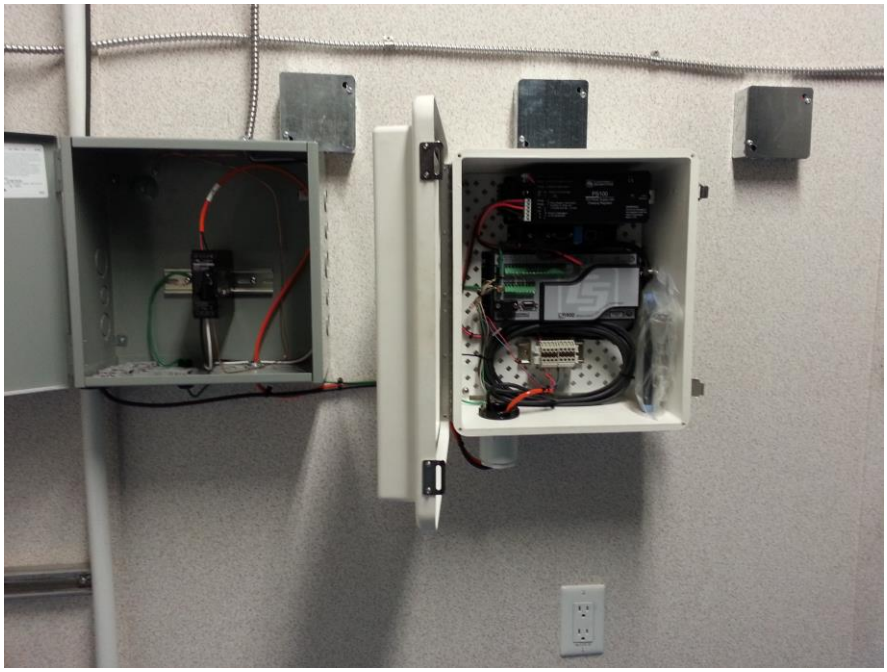


Figure 13: Inside Milne camp datalogger enclosure and sensor power supply enclosure (photo taken during 2014 trip)

Mary River Camp

The Milne Camp weather station equipment was installed by Campbell Scientific Canada Technician, Mike Ryder, in September 2014. Below is the list of equipment currently installed at this station:

Site Visit Date – Sept 18, 2015 CSC Technician: Travis Holder

Datalogger:

CR800

Power Supply:

PS100-8.5 Charger/regulator with rechargeable lead acid 12V battery

Z3749-ND – 120 to 24 VDC AC Adapter (Compatible for use with the WS600-UMB sensor)

Communications:

NL201-XT Ethernet interface – IP Address 10.20.2.17

Sensors:

WS600-UMB Lufft all-in-one smart weather sensor – includes Air Temp,RH, Barometric Pressure, Wind Speed/Direction and Precipitation.

Housing:

ENC 12/14 fiberglass waterproof enclosure (datalogger, Ethernet interface, and charger/regulator)

Mounting Structure:

Enclosure wall mounted inside on-site server room. WS600-UMB sensor mounted on top of user supplied pipe attached to outside of server room trailer wall.

Mary River Camp Station Maintenance Summary

The Lufft "all-in-one sensor" which remained installed at this station and was not exchanged with a replacement sensor. A functionality check and visual inspection was performed on the existing sensor.

The sensor was cleaned of dust built up and covering sensor. Please note that the red coloration on parts of this sensor is staining from this dust.

Data at this station was reviewed and no concerns with readings were noted. Confirmed functionality of the web page created during last year's trip which is still accessible at the following Baffinland internal network IP address: 10.20.2.17

Figure 14: Mary River camp WS600-UMB sensor installed on outside wall of server room trailer (photo taken during 2014 trip)

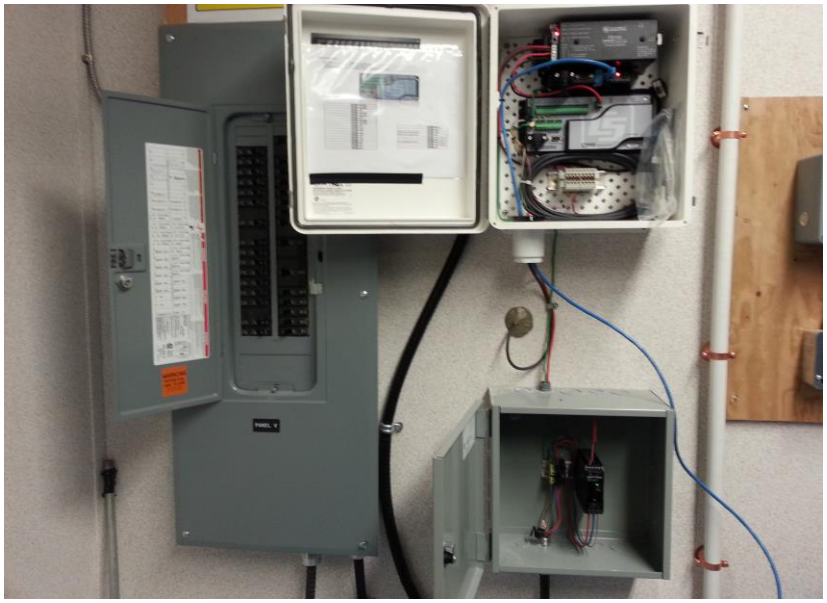


Figure 15: Inside Mary River camp datalogger enclosure and sensor power supply enclosure

Figure 16: Current condition of WS600-UMB Lufft sensor at Mary River Camp

Deposit No.1

The Deposit No.1 weather station equipment was installed by Campbell Scientific Canada Technician, Mike Ryder, in September 2014. Below is the list of equipment currently installed at this station:

Site Visit Date – Sept 22, 2015 CSC Technician: Mike Ryder

Datalogger:

CR1000

CFM100 Compact Flash Module with SD card

Power Supply:

BP 100 – 12V 100 AHr lead acid battery

Sensors:

05103-10 RM Young Wind Monitor

HC-S3 Rotronic Temp/RH Probe

Housing:

Existing Symboticware enclosure

Mounting Structure:

Existing communications repeater tower installed on top of on-site canister

Deposit No.1 Station Maintenance Summary

Datalogger:

This station does not currently have any remote communications installed so data can only be access directly from the datalogger upon a site visit to this station. Prior to any maintenance performed, all existing data was collected from the datalogger

Data for the last year was retrieved, reviewed and provided to the client. Upon review of the data, sections of 0 wind speed and wind direction for several days at a time were noted. The wind monitor at this station is prone to freeze up (as shown in the pictures below) which may explain values of zero for both wind speed and direction.

The datalogger lithium battery was recorded at 3.38 Volts, which indicates an acceptable voltage. The lithium battery requires replacement when reading 2.9 Volts or lower.

Due to time constraints, the enclosure desiccant was not replaced inside the datalogger enclosure at this station.

Power Supply:

The replacement PS150 battery was confiscated by airport authorities prior to arrival on-site. Therefore this battery and AC adapter were not installed as planned at this station.

The BP100 battery is not being charged at this station so voltage was recorded at 11.7 V. It is expected that the battery voltage will drop over time at this station.

Sensors:

A site lift was not available to access the sensors at this station. Due to safety concerns and regulations, maintenance was not performed on the sensors at this station.

Temp/RH: The HC-S3-XT sensor head could not be exchanged as the planned. The sensor radiation shield was partially covered in ice. While this may affect sensor air temperature and RH readings, the sensor remained functional as confirmed with review of collected data.

Wind Speed/Direction: The 05103-10 wind monitor speed bearings were not replaced as planned. This sensor was almost completely iced up, which will affect both wind speed and direction readings from this sensor.

Figure 17: Deposit No. 1 station installed on outside of existing site canister (picture taken during 2014 trip)

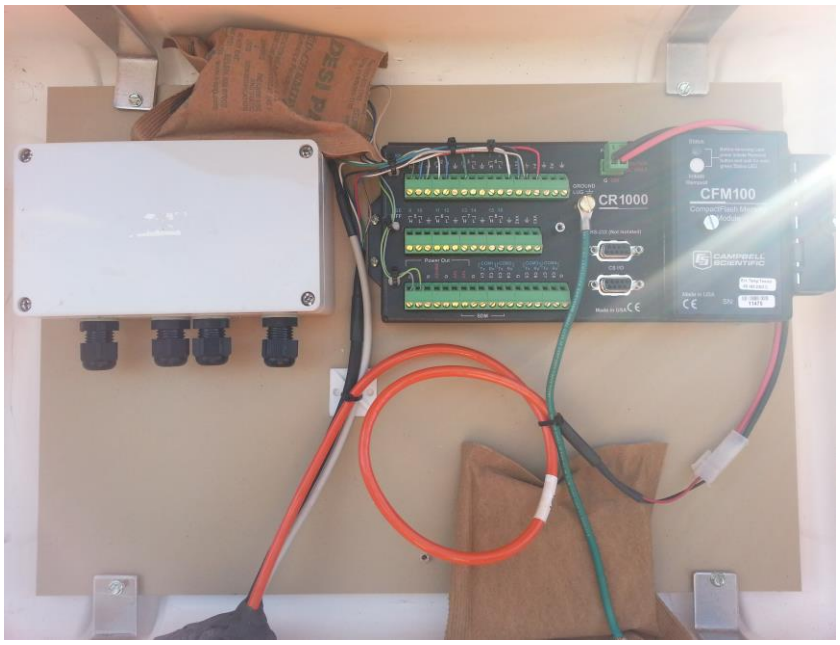


Figure 18: Inside Deposit No. 1 datalogger enclosure (picture taken during 2014 trip)

Figure 19: Ice cover on Deposit No. 1 station during 2015 trip

Figure 20: close up of Ice cover on Deposit No.1 sensors during 2015 trip

Action Items/Recommendations

General:
The next recommended field maintenance/calibration site visit for all stations is summer/fall 2016.

CSC will continue to monitor sensor data and battery voltage levels at the Milne, Mary River and Steensby remote met stations. CSC will notify the client if any issues arise.

Milne:

The current old generation cable entry port causes difficulty with running the current number of sensor cables into the station enclosure. Upgrading the enclosure port to the new larger version is recommended, but not absolutely necessary. This task was not performed during this year's maintenance trip. Extra time on site will need to be planned to replace this enclosure port as this will require drilling a larger port hole in the bottom the enclosure as well as re-wiring all sensor cable to the station datalogger.

Steensby:

The current old generation cable entry port causes difficulty with running the current number of sensor cables into the station enclosure. Upgrading the enclosure port to the new larger version is recommended, but not absolutely necessary. This task was not performed during this year's maintenance trip. Extra time on site will need to be planned to replace this enclosure port as this will require drilling a larger port hole in the bottom the enclosure and as well as re-wiring all sensor cable to the station datalogger.

Mary River and Milne Camp:

In order to prevent station down time and multiple site trips, a replacement calibrated sensor is recommended to be installed while the existing sensor is removed for recommended calibration or if sensor requires repair. The WS600-UMB sensor is not currently available through the CSC exchange program. In this case, the client will be responsible for purchase and management of a replacement sensor for these two stations.

Deposit No. 1:

This station is currently being powered only by the BP100 battery with no solar panel. The battery voltage has dropped as expected at this station. Recommend a site visit by the client to recharge the battery within the next 1-2 months, and then periodically over the year to maintain healthy voltage levels. Also recommend client to download data during site visits to avoid any loss of data as this station is not actively being monitored remotely.

Prior to proposed 2016 maintenance trip, discuss possibility of adding communications to this station and potential for data services provided by CSC similar to other three met stations.

Attachment 5: Long Term Meteorological Data Report

NORTH BAFFIN ISLAND INTELLIGENT MONITORING PROJECT REPORT ON LONG-TERM METEOROLOGICAL DATA

13 NOVEMBER 2009

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Project Overview

Our objectives were to retrofit three existing weather stations located on a north-south transect across northern Baffin Island with equipment that would allow improved data collection and system support, as well as enable satellite communication. The three stations were located at camps operated by Baffinland Iron Mines Inc. (henceforth, Baffinland). The weather stations had been installed and maintained by an environmental consulting company, Knight-Piesold (North Bay, Ontario) in 2005. The three sites were Milne Inlet (north shore of Baffin Island), Mary River (mid Baffin Island), and Steensby Inlet (south shore of Baffin Island) (Figure 1).

FIGURE 5-1: LOCATION OF THE THREE STUDY SITES ACROSS NORTH BAFFIN ISLAND

Site Description

Two of the sites, Milne Inlet and Steensby Inlet, are rocky, coastal marine habitats and the third, Mary River, is an inland site located on rocky, post-glacial till. All three sites are on a typical tundra terrain with till and exposed bedrock. The two shoreline habitats are close enough to the ocean to be strongly affected by marine weather. The weather station at Steensby Inlet sits on a flat, rocky island about 400 m from shore. It's essentially at sea level. The station at Milne Inlet is on a ridge overlooking the ocean and is about 1 km from the shore and at an elevation of about 90 m above sea level. The Mary River station is far enough from either coast not to be strongly influenced by sea-effect weather. All three stations are far from either artificial or natural obstructions, thus all data for insolation, wind, and temperature should represent normative local conditions.

Installation of the new equipment went well (see the associated report by Symboticware, North Baffin Island Intelligent Monitoring Project – Initial Technical Report). For unknown reasons, the station at Milne Inlet failed to transmit data via satellite shortly after it was retro-fitted. Despite repeated attempts at repair, that station is not transmitting data, although it continues to collect the data. The current functioning of the weather stations does not affect this report as the focus here is on analysis of the five years of existing data that were downloaded from the three weather stations.

Meteorological Variables and Methods

All three weather stations were standard Campbell Scientific (Edmonton, AB) units. They carried sensors for (a) air temperature and humidity, (b) light radiation, (c) light energy, (d) wind speed, (e) wind direction, and (f) rainfall (Table 1). In addition to the data collected by these sensors, the data loggers in the stations (Campbell Sci. model CR10X), also monitored (g) time and date, (h) battery power, and (i) internal temperature. Depending on the variable, data may be averaged over an hour, a day, or by hour then day. Some variables such as the standard deviation of wind direction, dewpoint, and wind chill are calculated based on standard equations that were programmed into the CR10X.

Importantly, there were considerable problems with functioning of the various data probes. No station had all probes working all of the time. Moreover, data collection at the different stations was switched on and off for unknown reasons over the five year study period. As a result, the data were discontinuous and some parameters were severely affected.

The data were processed to eliminate erroneous numbers. The CR10X writes a double line of data at the end of each day (2400). The second of these data lines is incomplete and these lines were eliminated. For most of the sensors, failure was indicated by a value of zero for the measured parameter except for the temperature probe which would return a value of about -72 °C. For the most part, these erroneous temperature readings were eliminated. For Steensby Inlet in 2008 and 2009, the erroneous temperature data were retained in order to illustrate the patterns shown by a failing sensor.

The data are presented as daily values, with each day of the year being numbered from 1 (1 January) to 365 (31 December). In the cases where the raw data were already averaged hourly (i.e., wind speed) these hourly averages were again averaged for each day. For solar radiation, only the noon (1200) readings were used.

Data Analysis

As a result of restrictions caused by damaged probes and non-operation of the data loggers, it was not possible to conduct analyses of long-term trends, or even to statistically compare among the three study sites. The analyses presented below are thus largely descriptive.

Overall System Function

The recording of time of day provided a convenient means of determining when the CR10X units in the weather stations were switched on and collecting data. The data recording times are presented as high-low graphs, wherein for each day (x-axis) a line is drawn between the hour (y-axis) of the start of data collection and the hour of the last collected data point (Figure 2-4). These figures illustrate the maximum potential period of data collection. Due to sensor failures, the data available are a subset of this potential range.

The Mary River station was set up in 2005, a year before the other two. For the first year of operation, the station was switched on only from late spring to early fall, and in 2006 was operated only during the summer (Figure 2). Data collection at the other two stations began in the fall of 2006 and it appeared that those units were left on year-round. We have no explanation for the frequent data outages at all three stations. A shutdown of a few (7-10) days may represent periods when the CR10X datalogger was shut down for data retrieval. It's unclear why this would have been necessary as the unit can record continuously with the data being stored on portable solid-state drives, which can be removed at any time for data download.

In 2009, the Steensby Inlet station was experiencing frequent failure (Figure 3). Perhaps the problem was temperature-related as the unit seemed to improve with the onset of summer. Nevertheless, this station eventually failed when it was retro-fitted in August 2009.

The Milne Inlet station seemed to operate fairly well, except that it was sometimes turned off for no apparent reasons (Figure 4).

TABLE 5- 1: *Explanation of the CR10X data variables. The first number in the storage label is the "port" whereby the data are read on the CR10X.*

Final Storage Labels	*Parameter*	*Units or Format*
0,101,5855	signals a new data line	
1,Year_RTM		integer year
1,Day_RTM		integer day
1,Hour_Minute_RTM		9999.999
2,Batt_Volt_AVG		volts
3,Prog_Sig~2,17673		
4,Rain_mm_TOT	rainfall	mm
5,AirTemp_AVG	air temperature	°C
6,RH_MAX	relative humidity	percent
7,RH_MIN	relative humidity	percent
8,Slr_W_AVG	solar radiation	Watts/m^2 (Joules/m^2/s)
9,Slr_kJ_TOT	solar radiation	kilojoules/m^2
10,WS_ms_AVG	average wind speed	m/s
11,WS_ms_MAX	maximum wind speed	m/s
12,WS_ms_MIN	minimum wind speed	m/s
13,WS_ms_S_WVT	average wind speed	m/s
13,WindDir_D1_WVT	wind direction	degrees
13,WindDir_SD1_WVT	std. dev. wind dir.	degrees
14,Tot24	total rainfall	mm
15,TdC_AVG	dew point	°C
16,HI_C_AVG	average heat index	°C
17,SunHrs_TOT	% hours of sunshine	99.99
18,WC_C_AVG	average wind chill	°C
19,WC_C_MAX	maximum wind chill	°C
20,WC_C_MIN	minimum wind chill	°C
21,10218768	unspecified	
22,Year_RTM,19892	repeated entry	
22,Day_RTM	repeated entry	
22,Hour_Minute_RTM	repeated entry	
23,Batt_Volt_MIN~1,6731	repeated entry	
24,Prog_Sig~2,19628	repeated entry	

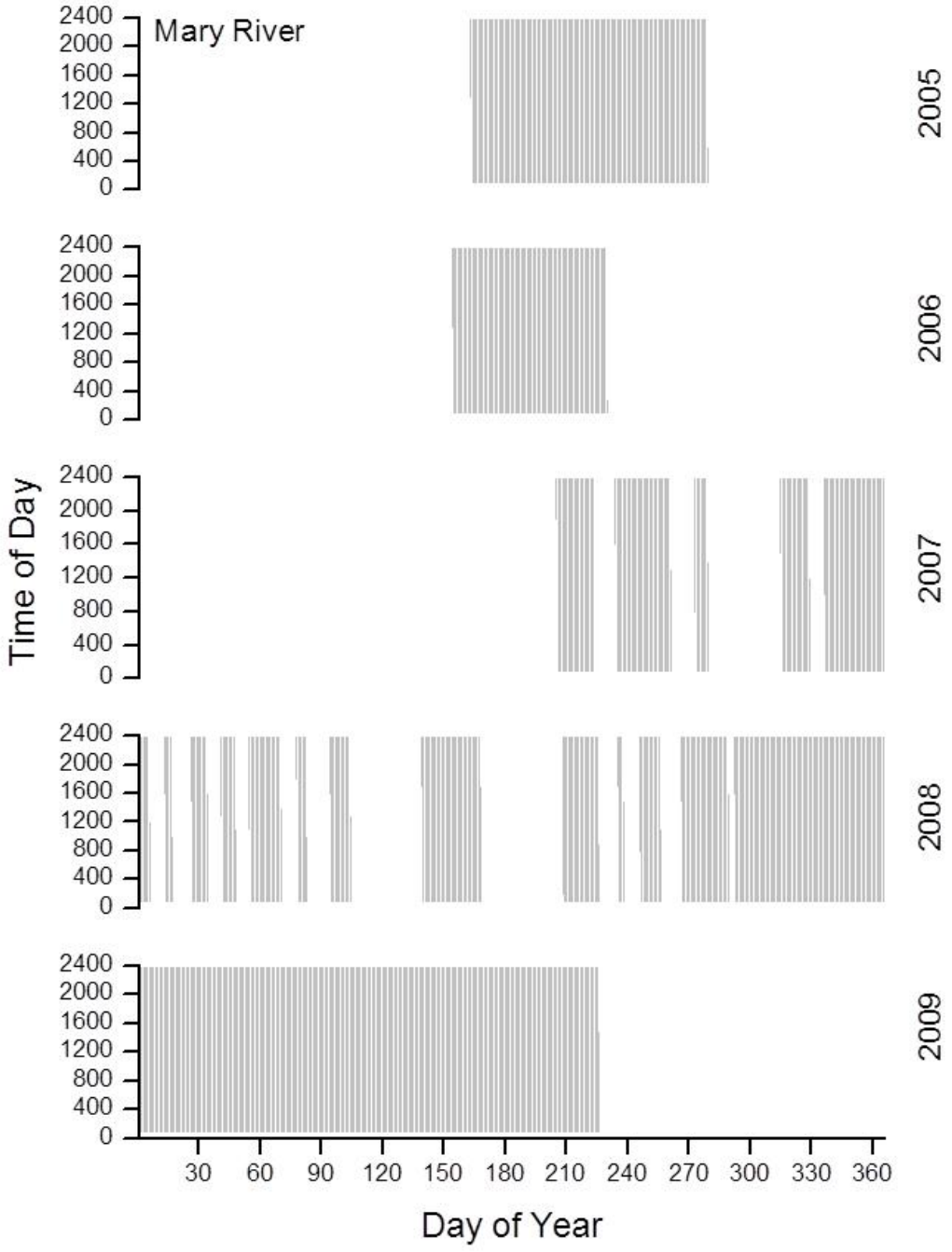

Figure 5-2: Data collection period for the Mary River station.

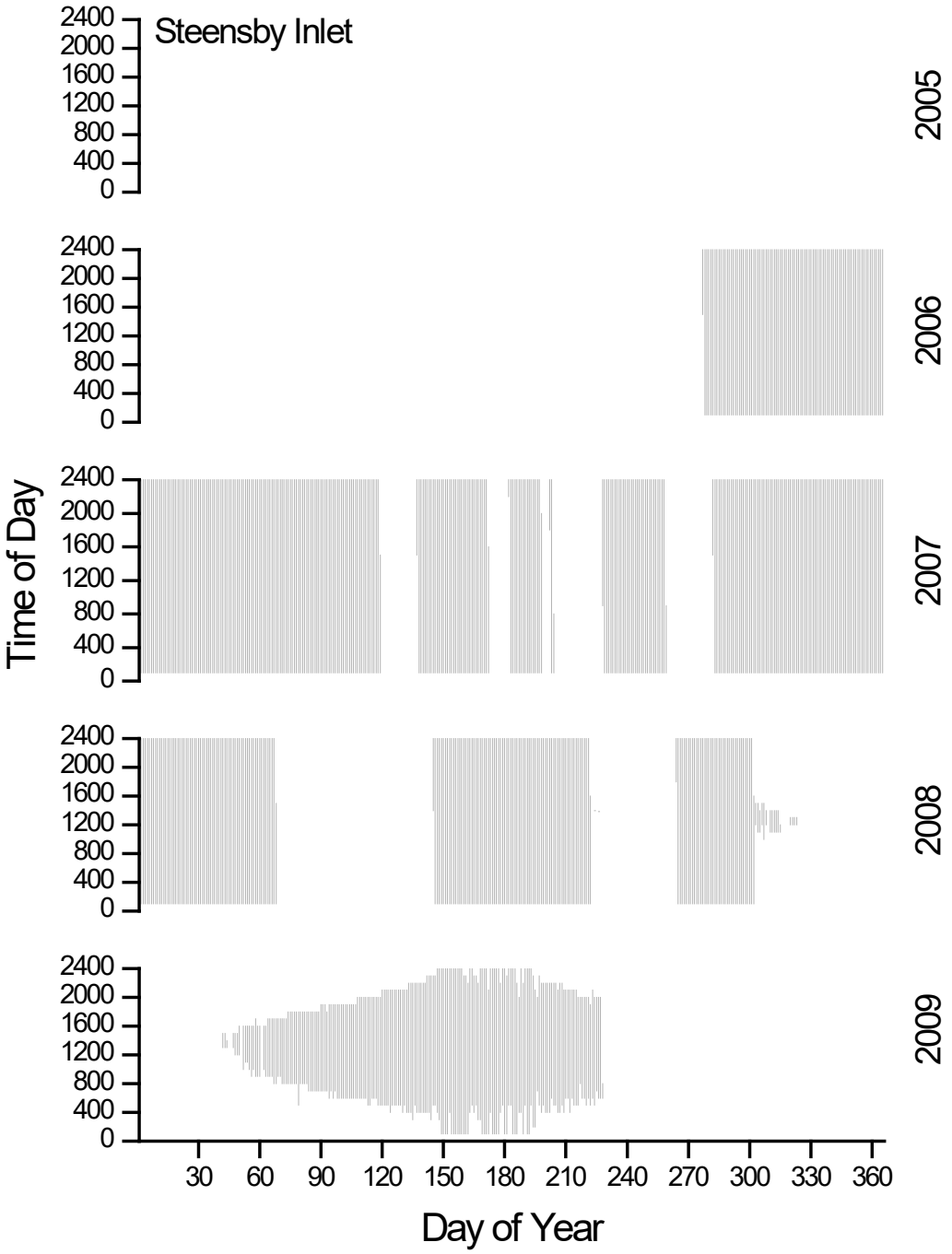

Figure 5-3: Data collection period for the Steensby Inlet station.

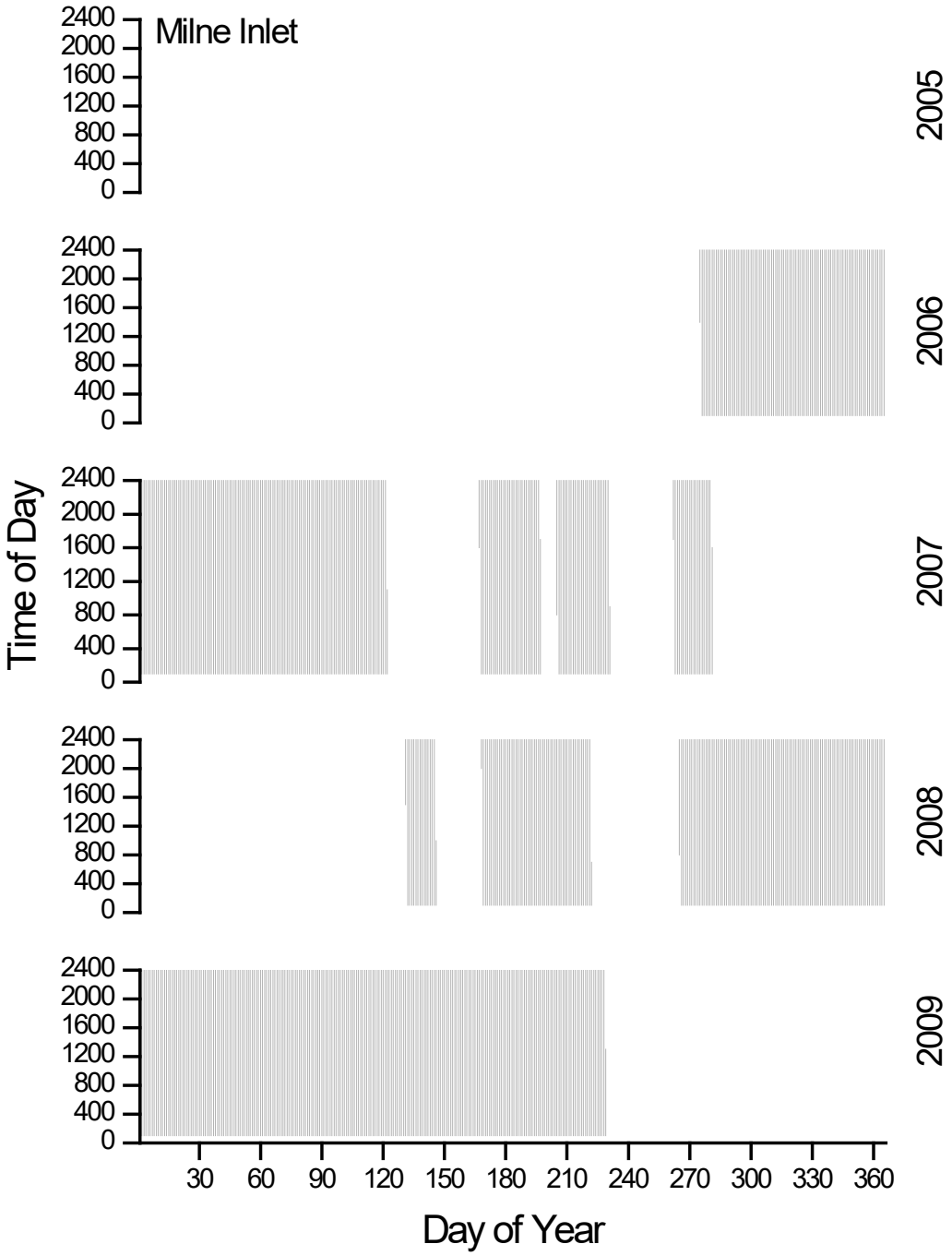

Figure 5-4: Data collection period for the Milne Inlet station.

Insolation

The weather stations record sunlight as both intensity (W/m^2) and energy ($kJ/m^2/s$), and here we report the former (Figures 5-7). Solar radiation varies with time of year and atmospheric conditions, especially cloud cover. These two factors interact. Solar levels are, of course, low to zero during the peak of winter but can be surprisingly high during a lot of the winter because cloud cover is usually low. Summer brings increased humidity thus cloud cover can reduce summer sunlight. It's mostly cloud cover that causes the high day-to-day variability in solar radiation.

At Mary River, the solar sensor operated every time the unit was turned on, but only until the fall of 2007 (Figure 5). The defective solar sensor was not replaced.

At Steensby Inlet, the solar sensor was installed only in 2007. This sensor was operational every time the unit was turned on. Since the sensor operated continuously, the seasonal pattern of rise and fall of solar radiation in the spring and fall, respectively, can clearly be seen in the 2007 to 2009 data series (Figure 6).

At Milne Inlet, similar patterns in solar radiation were evident as at Steensby Inlet (Figure 7).

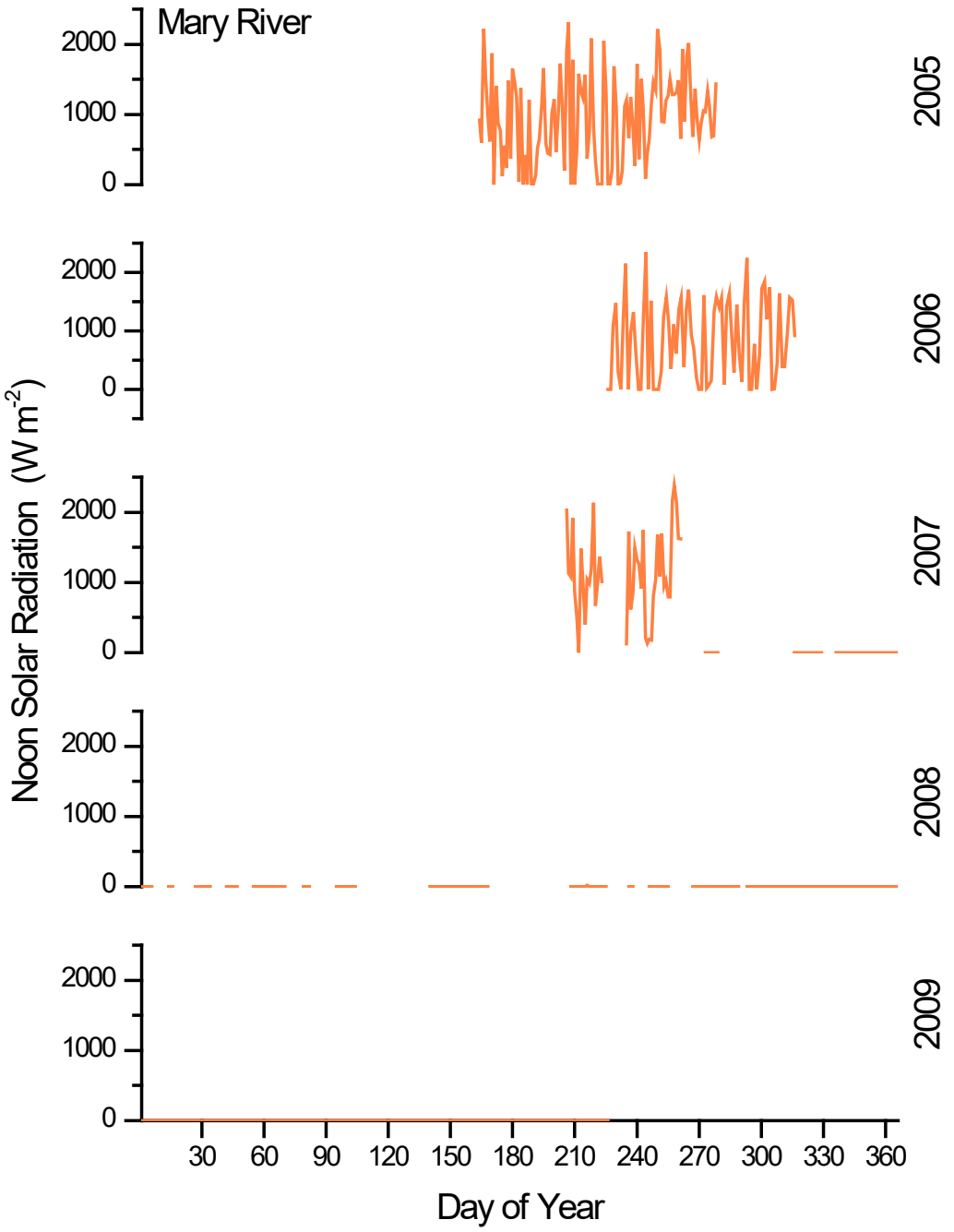

Figure 5-5: Noon solar radiation at the Mary River station

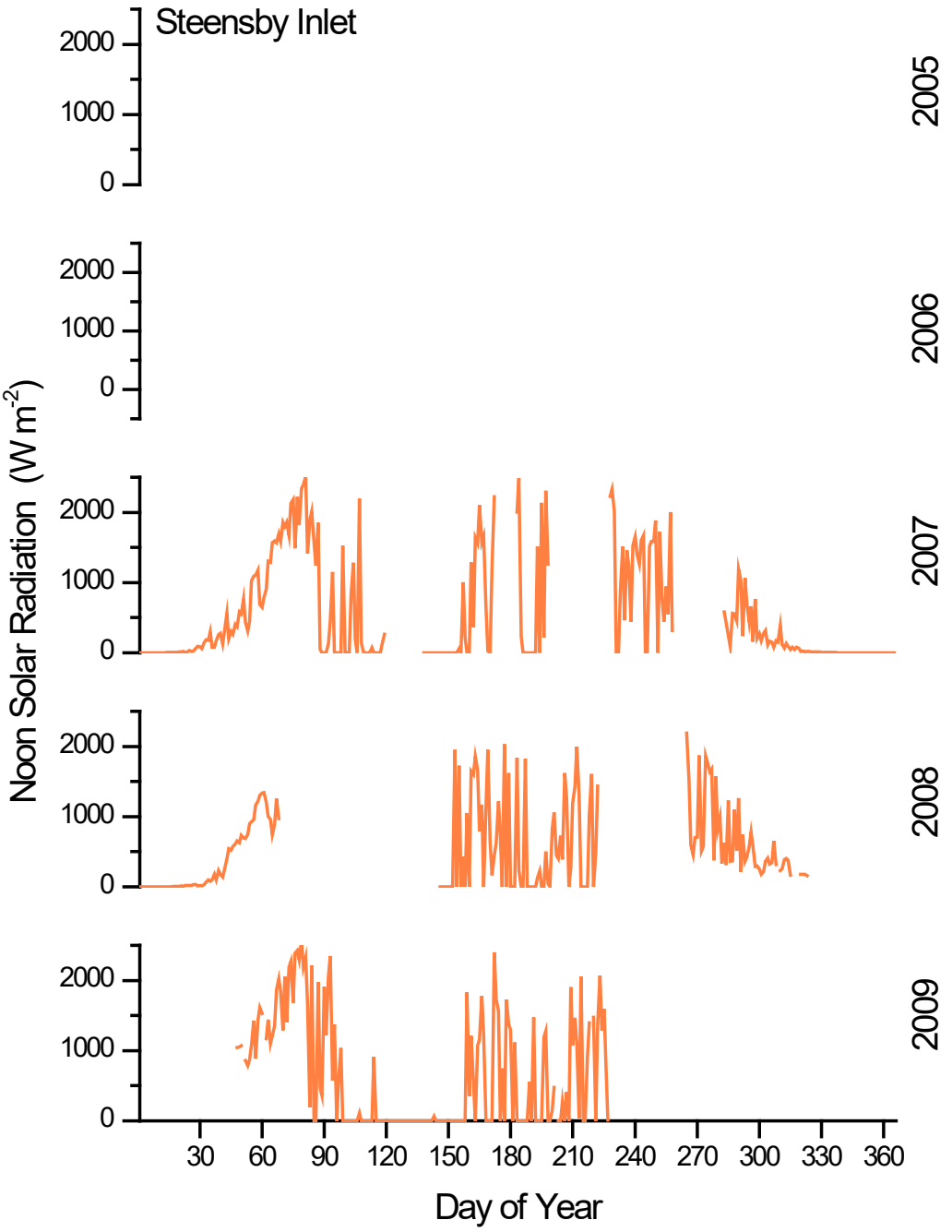

Figure 5-6: Noon solar radiation at the Steensby Inlet station.

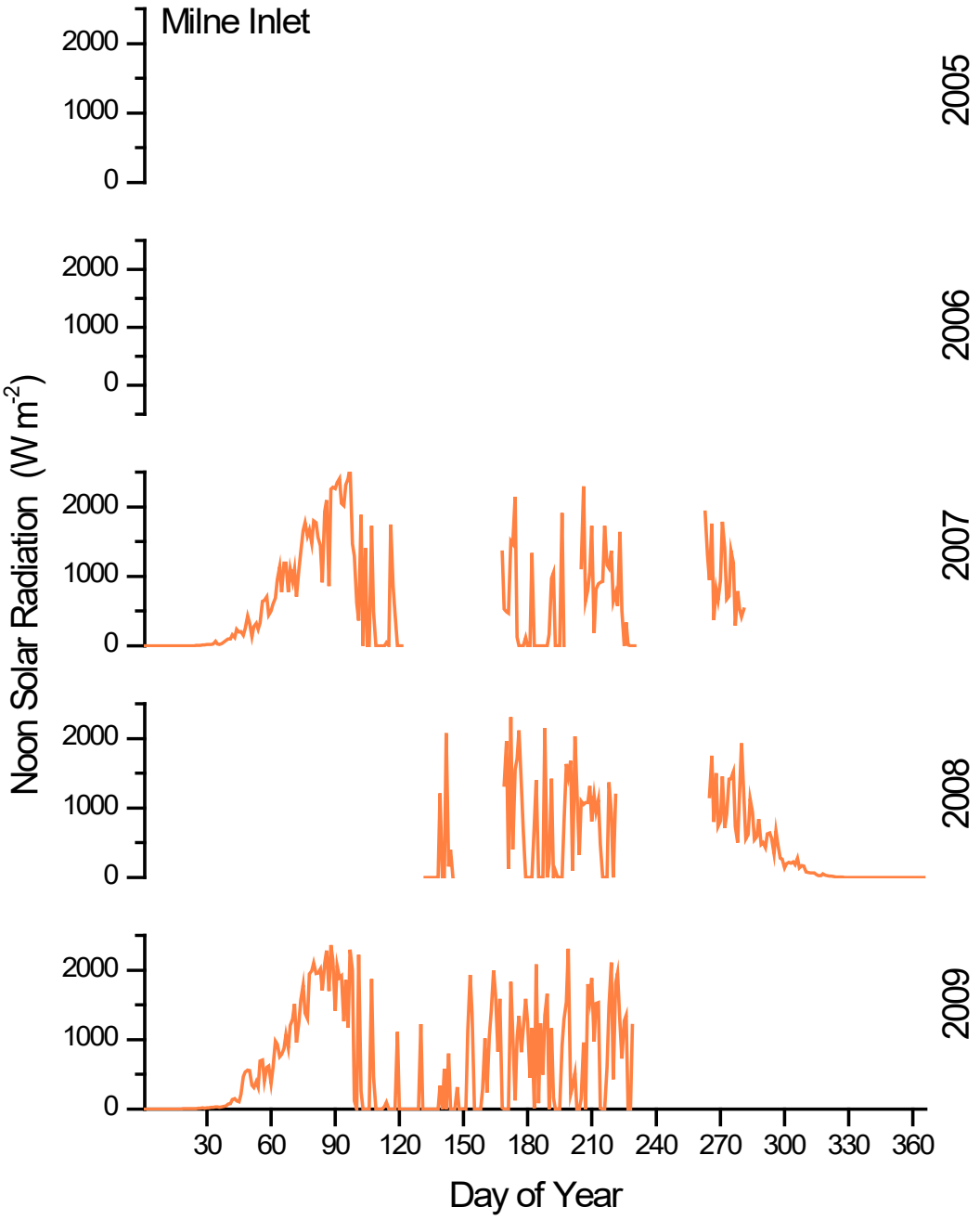

Figure 5-7: Noon solar radiation at the Milne Inlet station.

Air Temperature

Air temperature was measured by a combined temperature/humidity probe but the humidity data are not shown here. The temperature data were averaged over each day (black lines) with daily minimum (blue lines) and maximum (orange lines) values also shown (Figures 8-10).

Air temperature at the Mary River station was recorded whenever the station was turned on (Figure 8). Each year of data showed the expected seasonal pattern. It's not possible to compare the data among years because the station was too often switched off.

The Steensby Inlet station showed the same seasonality as the Mary River site (Figure 9). However, there was also some low temperature anomalies recorded as the temperature/humidity sensor began to fail in 2007 and 2008, and finally failed completely in 2009.

The Milne Inlet station also showed the seasonal patterns of the other two stations (Figure 10). In this case, the temperature/humidity probe continued to operate from 2006 to 2009. All data gaps were caused by the recording unit being switched off.

In future analyses, it would be interesting to compare temperature variability at the inland site relative to the two shoreline sites. The ocean should provide a moderating influence on air temperature at Steensby and Milne Inlets.

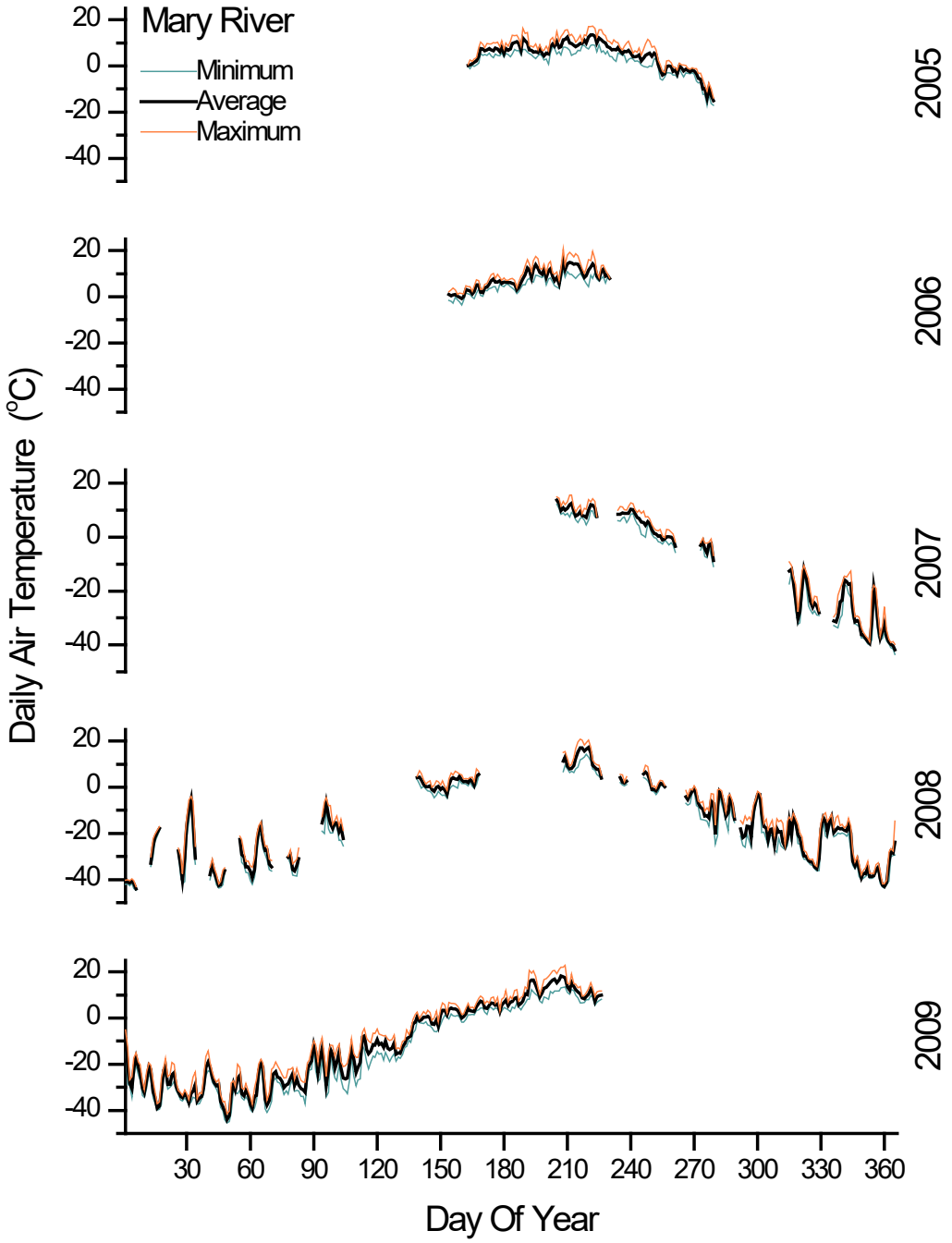

Figure 5-8: Air temperature at the Mary River station.

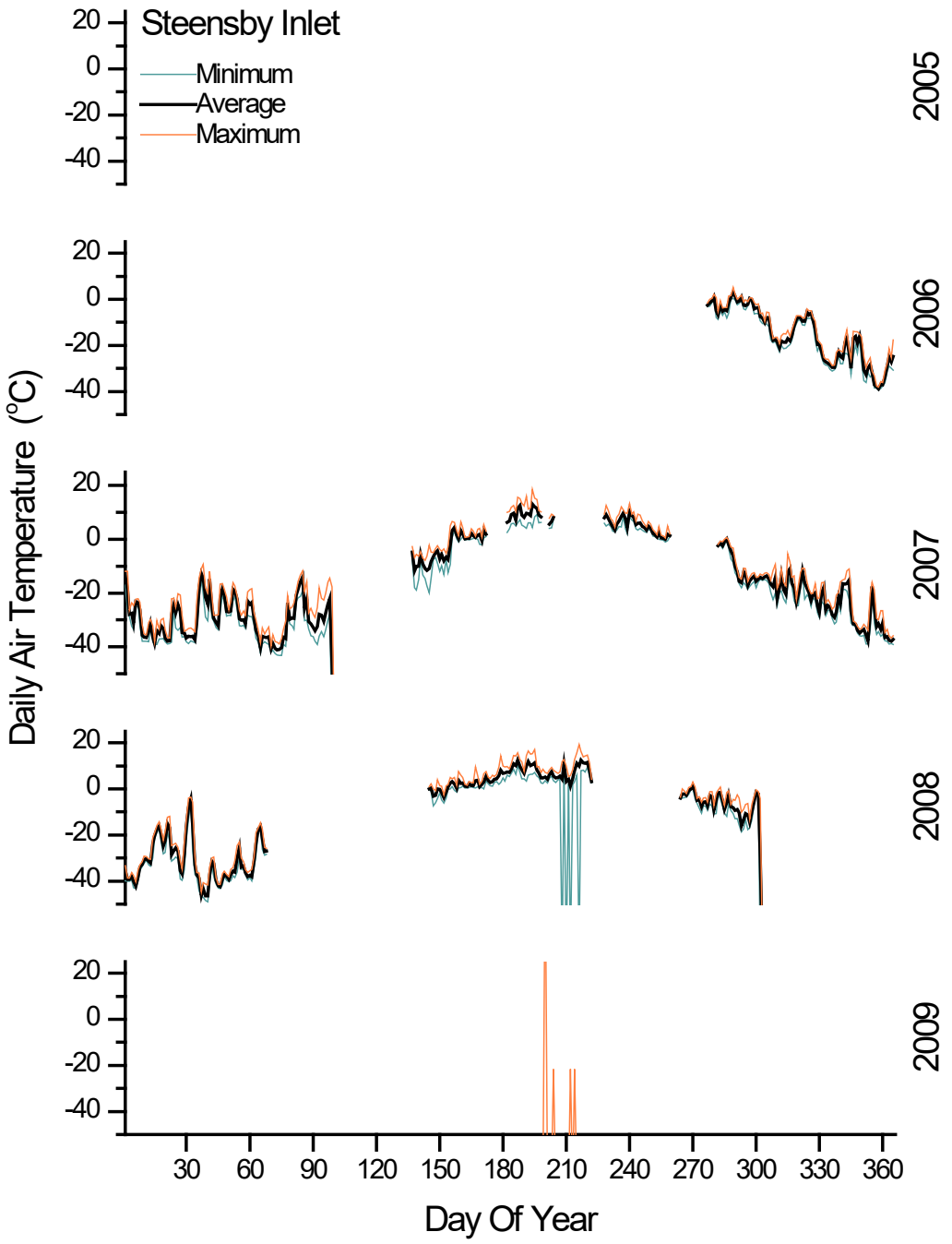

Figure 5-9: Air temperature at the Steensby station.

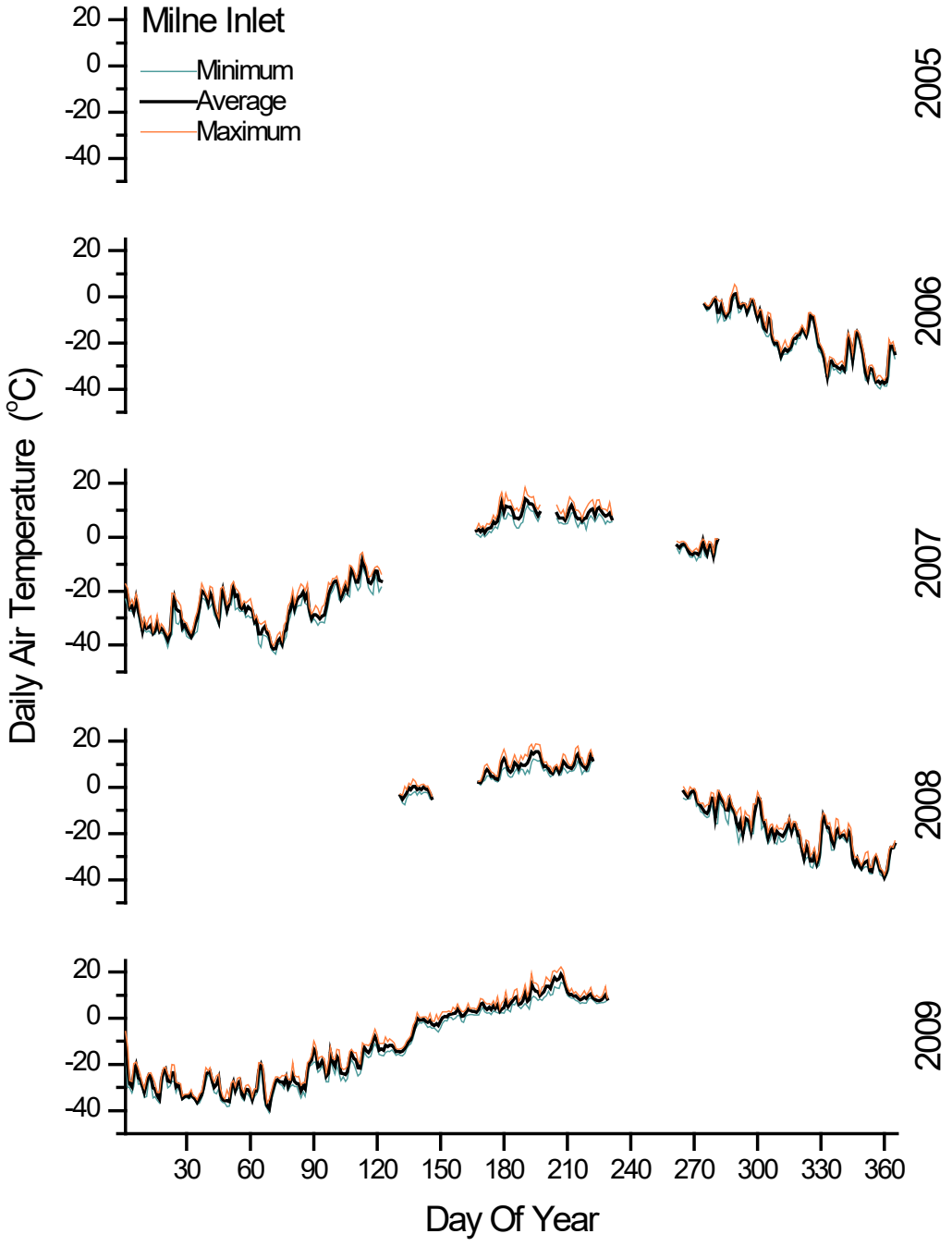

Figure 5-10: Air temperature at the Milne Inlet station.

Daily Rainfall

Rainfall was recorded by a tipping-bucket collector. This type of sensor can only record rain and is largely inoperable with any dry or semi-dry precipitation (i.e., snow and freezing rain). Thus the data on precipitation are available only from late spring to early fall (Figures 11-13).

Total daily rainfall was highly variable at the Mary River site (Figure 11). For the most part, rain seemed to occur in isolated events ("spates"), not as long-term precipitation. Overall, rainfall was not high which is expected in this fairly arid arctic region. In 2008 there were extended periods when the rain gauge reported values of zero even during the summer. Perhaps the gauge was malfunctioning during that time as the Steensby and Milne Inlets stations did record precipitation.

The Steensby Inlet station recorded much more rainfall than the other two sites (Figure 12). (Note the change in y-axis scales between Steensby Inlet and the other two sites.) This coastal, south shore site is clearly in a wetter climate than the other two sites. The temporal pattern of rain seems similar to Mary River and Milne Inlet, however. Rain seems to come at the same frequency at Steensby Inlet, it just rains much more when it does arrive. In 2009 the rain gauge at Steensby Inlet failed, likely due to damage by a polar bear.

Milne Inlet showed very little rainfall but it's unclear whether this was a real pattern or whether the rain gauge was malfunctioning (Figure 13). Comparing Figures 4 (data recording period) and 13 (rainfall) for Milne Inlet indicates that the rain gauge itself was turned off, independently of the recording unit. Where both the data logger and the rain gauge connected, the rainfall data would have shown zeros during freezing periods but we don't see this in the data stream. Eventually, the rain gauge at Milne Inlet failed completely by 2009.

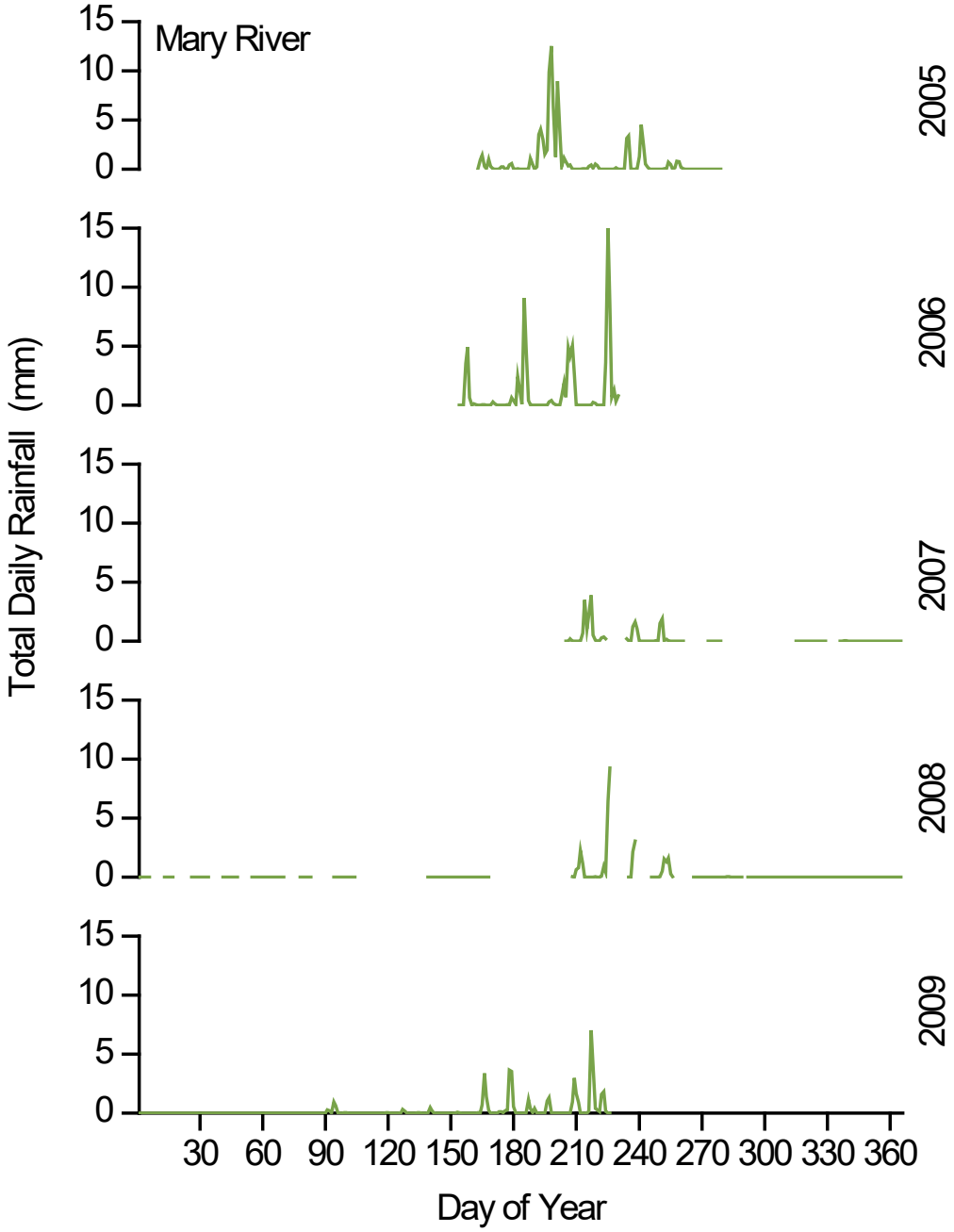

Figure 5-11: Daily rainfall at the Mary River station.

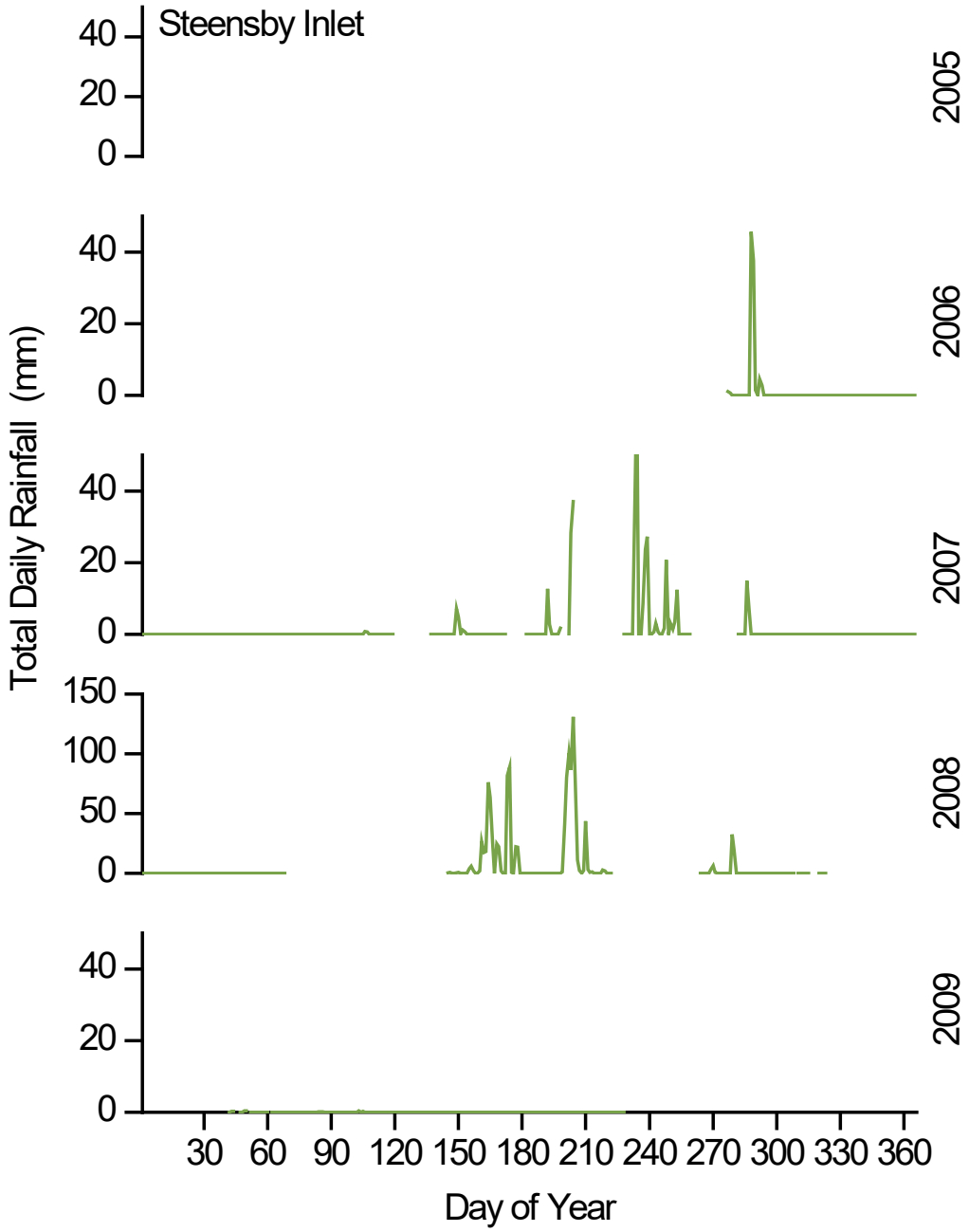

Figure 5-12: Daily rainfall at the Steensby Inlet station. Note the change in y-axis scale relative to the other figures; 2008 is on yet another scale.

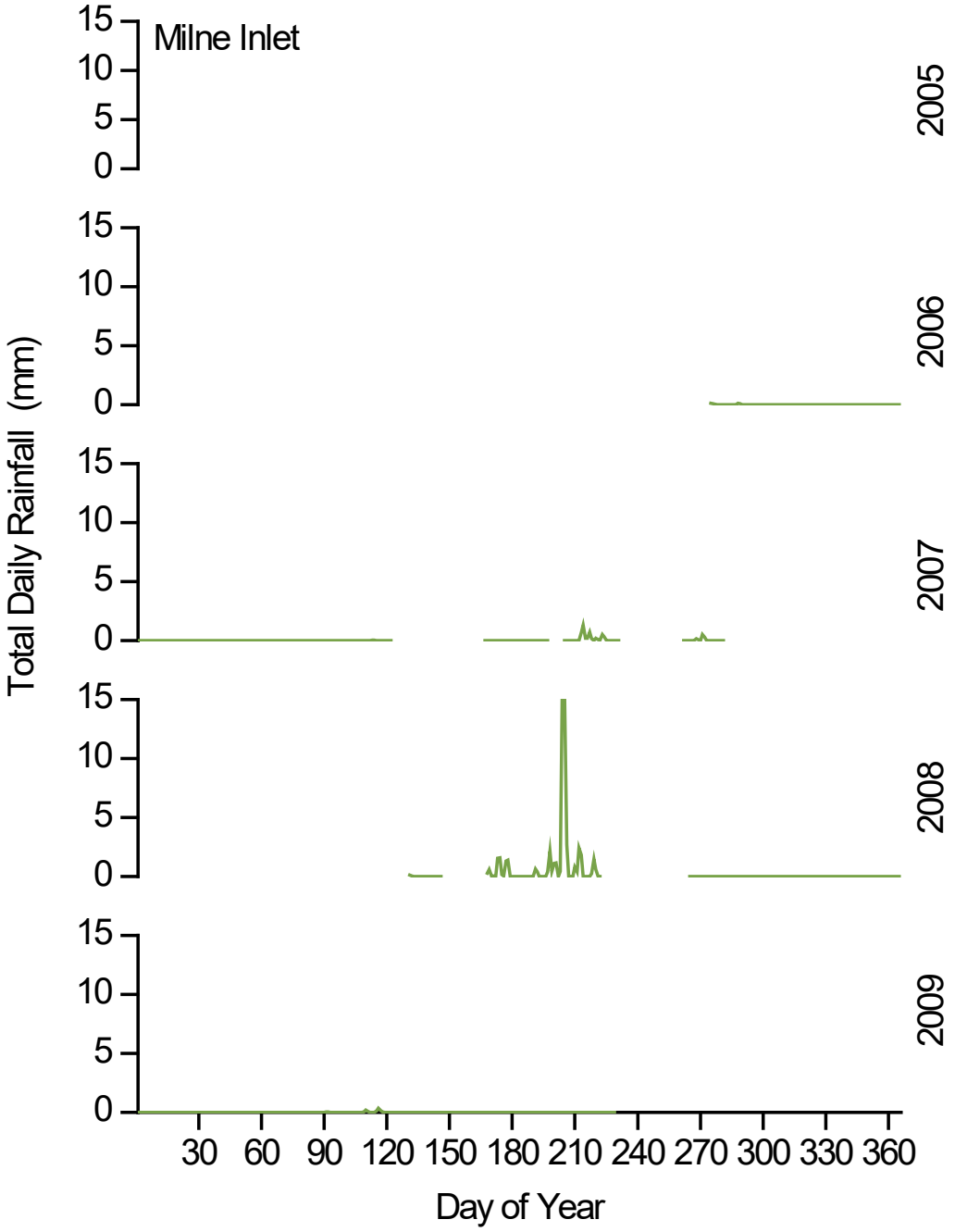

Figure 5-13: Daily rainfall at the Milne Inlet station.

Wind Speed

Wind speed was averaged over each day. Ordinarily, weather stations carry two different anemometers, one for low (cup style) and one for high (propeller style) wind speeds. The Mary Inlet station had both anemometers but only the high-speed one was connected and operational. The other sites had only high-speed sensors. The use of high-speed sensors is appropriate at these sites as wind speeds are typically high. The landscape is barren and open, thus wind is supported by a large fetch (clear landscape for building force). At all sites, wind speeds would often approach 20 m/s which is equivalent to 72 km/h.

Wind speed at Mary River showed a good data series (Figure 14) as recording occurred whenever the datalogger was switched on. Significant wind (Beaufort Scale values of 4-6) was almost always present, with frequent fluctuations that approached gale-force conditions (Beaufort 6-8).

The Steensby Inlet station also showed a very good data series for wind speed (Figure 15). At this site, wind speed was perhaps a bit more moderate than at Mary River, and did appear to also be a bit less variable.

The Milne Inlet station again had a good data series for wind speed (Figure 16) and seemed more similar to Mary River in terms of the intensity and variability in wind speed. The Milne Inlet station is located atop a high ridge and perhaps experiences higher wind than if it were located at sea level like the Steensby Inlet station.

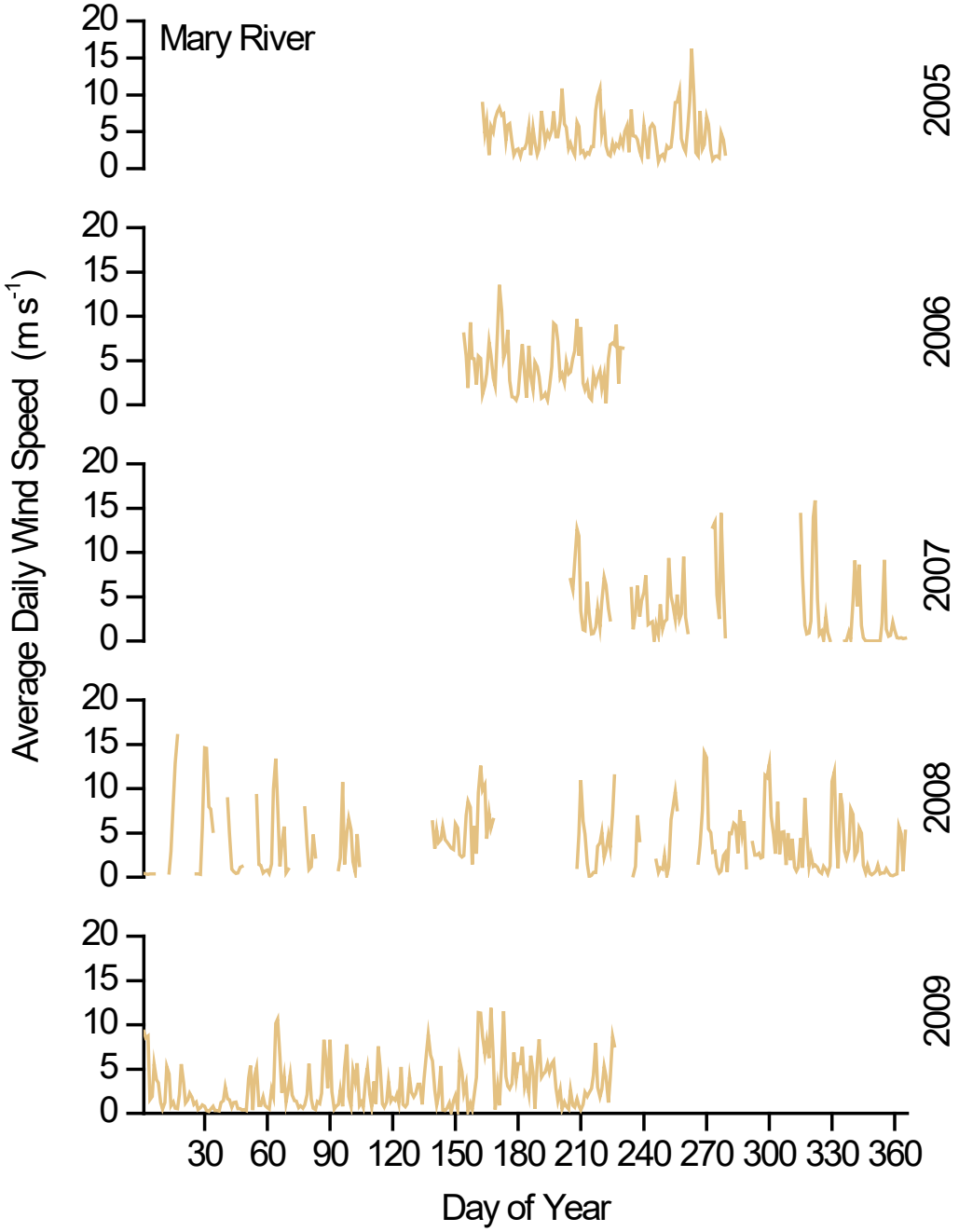

Figure 5-14: Average daily wind speed at the Mary River station.

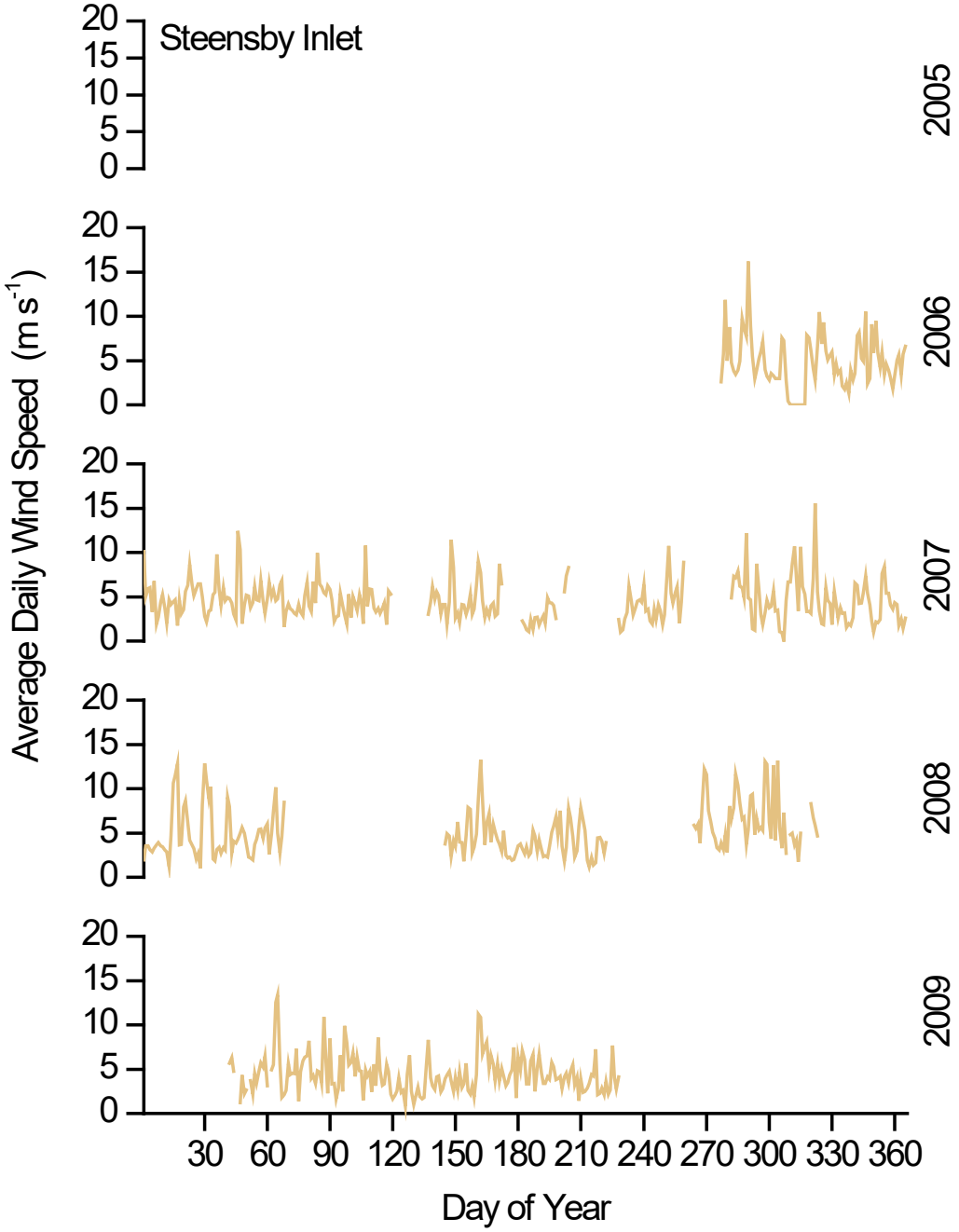

Figure 5-15: Average daily wind speed at the Steensby Inlet station.

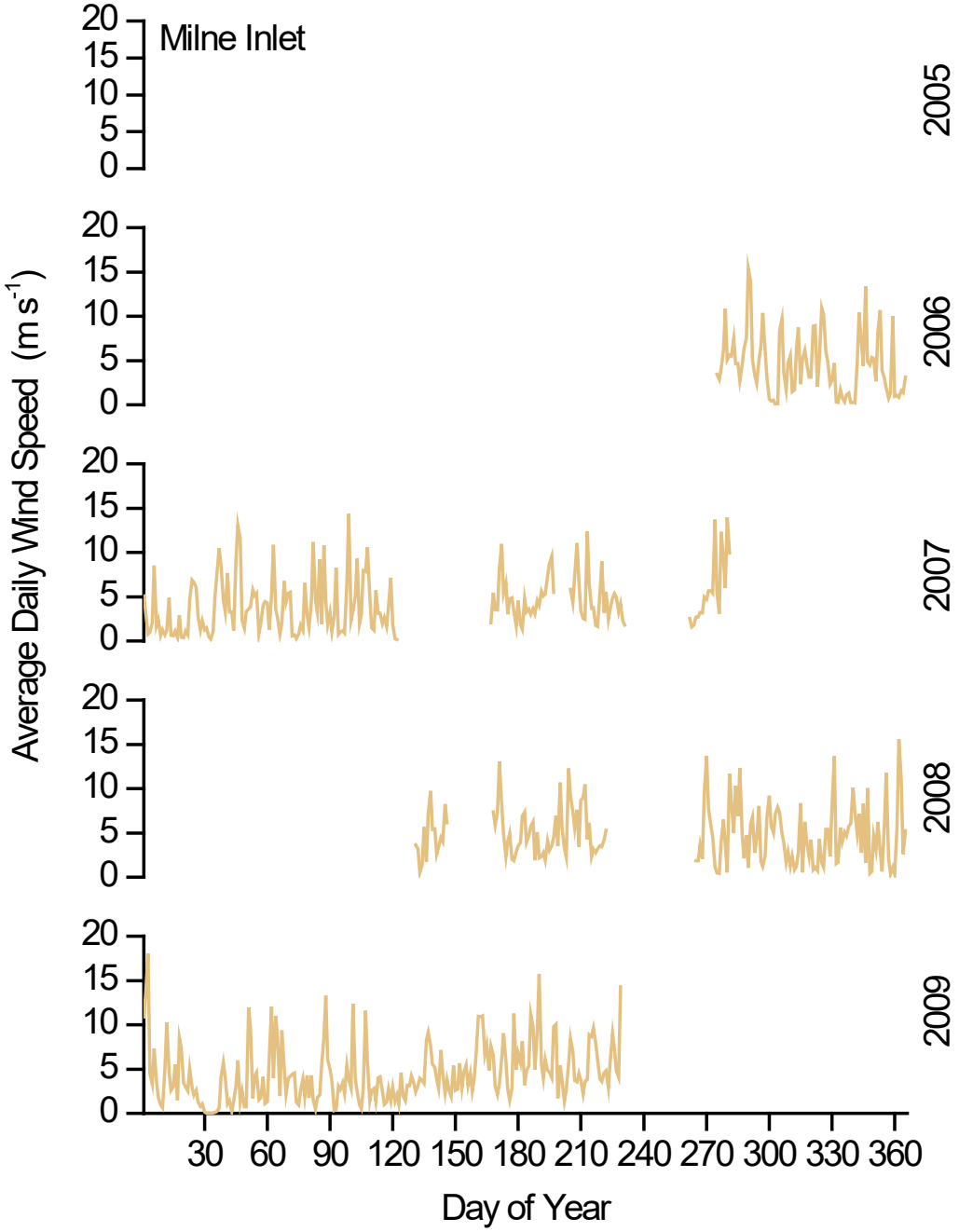

Figure 5-16: Average daily wind speed at the Milne Inlet station.

Attachment 6: Dustfall Monitoring

The dustfall monitoring program considers all potential dustfall sources, including the Mine and Milne Port point sources as well as the Tote Road linking the two sites.

Objectives

There are two main objectives of the dustfall monitoring program:

1. To determine the extent and magnitude of dustfall at sampling locations associated with the mine site, Milne port site, and Tote Road; and
2. To determine seasonal variations in dustfall at all sampling locations.

Methods

Passive dustfall monitoring methods are used to determine the deposition of fugitive dust from point sources and haul roads. A total of 39 dustfall sampling sites exist. (Figure 1 below):

- Nine (9) dustfall samplers located at the Mine Site (three within the Mine Site, four outside the mine footprint within low to moderate isopleth areas and two references sites; one to the northeast, and one to the south) located at least 14,000 metres (m) from any Project infrastructure, outside of the extent of expected dustfall;
- Six (6) dustfall samplers located at Milne Port (five active sites on the Port Site footprint; and 1 reference site located northeast of the Port Site outside of the predicted extent of dustfall;
- Sixteen (16) dustfall samplers divided between two (2) sites along the Tote Road (North sites and South sites). These two sites are organized into transects, each composed of 8 dustfall samplers distributed perpendicular to the Tote Road centreline at 30 m, 100 m, 1,000 m, and 5,000 m on either side of the road;
- Two (2) reference dustfall samplers located 14,000 m southwest of the Tote Road (one at the north site, one at the south site); and,

In 2019, modifications were made to the dustfall monitoring program to include:

- The addition of six (6) dustfall samplers along the Tote Road. These six monitors comprise three pairs, located 1,000 m distant from the Tote Road on its east and west sides at km 25, 56 and 75.
- To accommodate expansion of the ore stockpile area at Milne Port site DF-P-01 was relocated to the boundary of the PDA. The new site is called DF-P-08 and the move was completed in May 2019.

Each dustfall sampling site is comprised of one sampling apparatus, which is made up of a hollow post (~ 2m long) and terminal bowl shaped holder for the dust collection vessel. The terminal bowl is topped

with bird spikes to prevent contamination by bird fecal matter. The sampling apparatus was installed by pounding 5-foot rebar into the ground, placing the post over the rebar, and then stabilizing with guy wires.

Dust collection vessels are placed in the holder, pre-charged with 250 mL of algaecide in summer and 250 mL of alcohol in winter. Collection vessels are changed out every month (28–31 days) and shipped to an accredited laboratory for analysis of total, fixed and volatile insoluble particulate matter. The sampling is conducted in accordance with methods outlined in ASTM D1739-98 (Re-approved 2010).

Dustfall sampling is conducted year-round; however, the winter sampling program is limited to a subset of the sampling sites because access to remote sites is restricted. The sites not visited over the winter months were the most remote from the Mine Site, Tote Road and Milne Port. Because of their distance from disturbances, those sites are exposed to minimal project-initiated dustfall.

In addition to the analysis of dustfall, the dustfall samples were analyzed for total metal concentrations to help inform potential trends in soil and vegetation tissues, collected as part of vegetation health monitoring.

Photo 1: Dustfall collector sampling apparatus (from Rescan 2012).

The resulting data was reviewed for differences in the magnitude of dustfall from different sources (Mine, Milne Port, and Tote Road), seasonal variations, and total annual dustfall. Additionally, results are reviewed to determine the concentrations present at point sources in comparison to background sites, as well as concentrations changes with distance from the road centerline.

Finally, using wind directions and strength data available through the climate monitoring program, the effect of wind on dustfall deposition can be investigated. Previous to this study, dustfall monitoring in northern Canada has been conducted during the summer months. Results from this monitoring program will allow the collection of seasonal dustfall data. Appropriate mitigation measures for the protection of caribou habitat can be determined through increased knowledge of the extent and magnitude of dustfall throughout the project area. In addition, data concerning the seasonal fluctuations of dustfall can allow for the application of seasonal-specific mitigation measures.

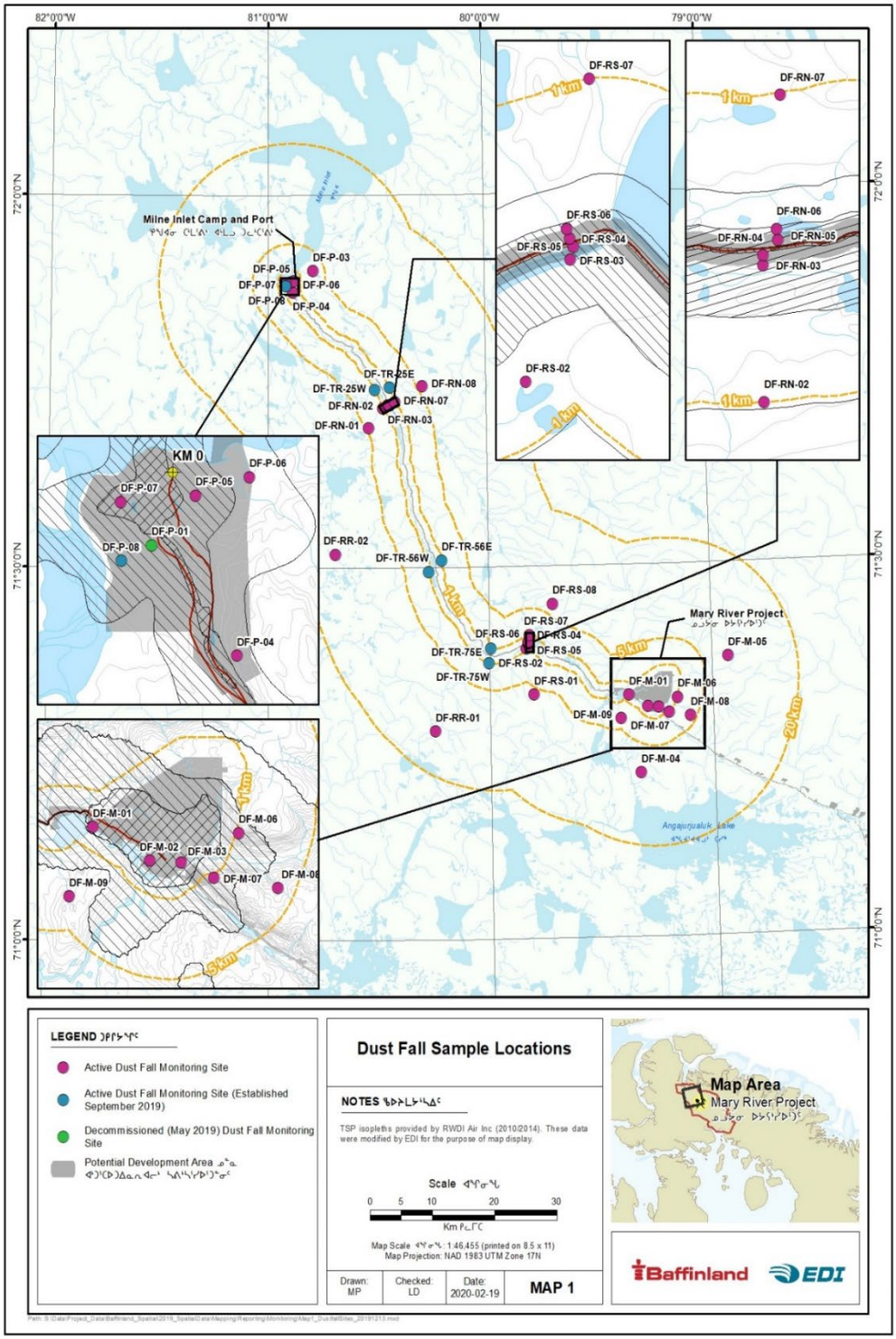

Figure 6-1: Dustfall Sample Locations

References

Boulanger J., Poole K.G., Gunn A., and J. Wierzchowski. 2012. Estimating the zone of influence of industrial developments on wildlife: a migratory caribou *Rangifer tarandus groenlandicus* and diamond mine case study. Wildlife Biology 18:2.

Rescan Environmental Services Ltd. 2012. Ekati Mine 2011 Air Quality Monitoring Program. Produced for: BHP Billiton Canada Inc.

Attachment 7: Dust Management Protocol

Baffinland Iron Mines Corporation
Mary River Project

Dust Management Protocol for the Mary River Project Roads

Revision No.:	B	**Procedure Number:**	
Revision Date:	April 30, 2021	**Date Reviewed:**	April 30, 2021
Date Revision Effective:	April 30, 2021		

1. Introduction

Under Baffinland Iron Mines Corporation (Baffinland) project approvals from the Nunavut Impact Review Board (NIRB), Baffinland has committed to "developing and implementing mitigation measures which control fugitive dust emissions" (NIRB, Final Hearing Report Terms and Conditions, Dec 28, 2012, Appendix A, #2). The objective of this Dust Management Protocol for the Mary River Project roads is to establish the operational requirements that will be implemented on the Mary River Project (the Project) to meet this commitment and the commitments established in the Mary River Project Health, Safety and Environment Policy (2019) to achieve a safe, health and environmentally responsible workplace.

Dust is an inevitable problem on all project roads and the control of dust must be a fundamental part of any environmental management plan. Dust on project roads is formed when fine particles become entrained in the atmosphere by the turbulent action of wind or by the mechanical disturbance of fine materials. Dust is a concern from safety, health, environment and operational standpoint. Dust can lead to the following conditions:

- Decreased visibility along project roads leading to increased risks of vehicle accidents.
- Potentially adverse health effects for people who inhale airborne particles (especially a concern for people with prior respiratory issues).
- Potentially adverse environmental effects including limiting photosynthesis levels on plants due to dust deposition and introducing contaminates to water ways.
- Premature wear on engines and motor vehicles from increased inhalation of fine particles into engines on roadways.

To help mitigate these concerns, the Mary River Project will employ the following protocol to manage dust on project roads.

2. Dust Suppression Protocol

2.1 Determining When Dust Suppression is Required

Dust suppression methods may only be used on Mary River Project Site Roads when 'significant' dust generation is occurring. The determination if dust generation is significant is at the professional opinion and discretion of the Senior Construction Representative on-site with consultation with the Baffinland Environmental Department Representative on-site.

As a guideline, dust that is visibly being carried as a cloud off the roadway should be considered significant.

2.2 Primary Dust Suppression – Water

The wetting of road surfaces with water will be the primary method to mitigate dust concerns on the Mary River Project roads. If *significant* dust generation is occurring the following conditions shall be adhered to for the wetting of road surfaces with water:

- Water shall be collected only from approved sources as directed by the on-site Baffinland Environmental representative to ensure that the quality of water being used for dust suppression meets all water quality requirements for discharge under the Projects water use licenses and land use permits.
- Contaminated water shall not to be used for dust suppression.
- Water shall be applied to roads using on-site water trucks using a spray bar arrangement.
- The rate of water application should be enough to suppress dust but not sufficient to allow water to puddle or pool on the road surface.
- The frequency or rate of water application will vary depending upon the prevailing site conditions and shall be determined by the Senior Construction representative on-site with consultation with the Baffinland Environmental Department representative on-site.
- Only trained operators assigned and trained on the water truck operation shall be used to apply water on Mary River Project site roads to suppress dust on a as required basis.
- On a daily basis water volume and source used for dust suppression shall be tracked by and reported to the Baffinland Environmental Department representative on-site.

2.3 Secondary Dust Suppression Products

The Government of the Nunavut, Environmental Protection Service, Department of Sustainable Development has a guideline, Environmental Guideline for Dust Suppression (as shown in Attachment A), that sets out requirements to be followed when using chemical dust suppressants in Nunavut. The Mary River Project has restricted the list of approved chemical dust suppressants on project roads and the airstrip to calcium chloride ($CaCl_2$), Dust Stop Municipal Blend, and EK35® Synthetic Organic Dust Control.

2.3.1 Calcium Chloride ($CaCl_2$)

Calcium Chloride ($CaCl_2$) may be applied as a dust suppressant on Mary River Project roads if measures are needed to mitigate the safety, health, environmental and/or operational concerns arising from dust generation on Project roads and if primary dust suppressant is deemed to be

ineffective due to operational restrictions (e.g. equipment/operator availability), weather conditions or safety reasons. The Safety Data Sheet (SDS) for $CaCl_2$ is provided in Attachment B.

It is at the discretion of the Senior Construction representative on-site with consultation with the Baffinland Environmental Department representative on-site if the use of $CaCl_2$ as a dust suppressant is necessary.

If 'significant' dust generation is occurring and secondary dust suppression is deemed required, the following conditions shall be adhered to for the application of $CaCl_2$ on Mary River Project roads. $CaCl_2$ shall be applied to in a granular or brine solution.

2.3.1.1 *Application Timing*

- If possible, $CaCl_2$ should be applied to a lightly wetted road or scheduled after a light rainfall, when unpaved road surfaces and accumulated aggregate are damp and better able to absorb control measures.
- While damp surfaces are desirable, working in rain or on overly wet/saturated roadbeds shall be avoided as $CaCl_2$ is more easily transported in runoff to roadside soils and nearby watercourses.

2.3.1.2 *Granular Application*

- As a guideline, 0.5 kg of $CaCl_2$ shall be applied for every square meter of road area (or 1 lbs/yd).
- If possible, granular $CaCl_2$ shall be applied using a spinning disk vehicle mounted system. If a vehicle mounted system is not available, $CaCl_2$ shall be applied in accordance with all other requirements evenly across project roads manually.
- Granular $CaCl_2$ shall be applied to a pre-wetted surface (or after a light rainfall) however, avoid applying $CaCl_2$ to overly wet or saturated roadbeds where there is a high potential for chemical transportation.
- Ensure the application of granular $CaCl_2$ is limited to the travelled road surface.
- Be cautious applying granular $CaCl_2$ to road surfaces near watercourses or over watercourse crossings.
- Only a trained personnel shall be used to apply granular $CaCl_2$ on Mary River Project Site Roads to suppress dust on a as required basis.
- Have a spill response plan in place and a functional spill kit on each applicator and/or in application area.
- On a daily basis volume of granular $CaCl_2$ shall be tracked and reported to the Baffinland Environmental Department representative on-site.
- Ensure all equipment used on site is well maintained and free of fluid leaks.

2.3.1.3 *Brine Production*

- Water for brine solution shall be collected only from approved sources as directed by the on-site Baffinland Environmental representative to ensure that the quality of water being used for dust suppression meets all water quality requirements for discharge under the mine's water use licenses and land use permits.
- Contaminated water shall not to be used for $CaCl_2$ brine solution production.

- On a daily basis water volume and source used for brine production shall be tracked by and reported to the Baffinland Environmental Department representative on-site.

2.3.1.4 *Brine Application*

- $CaCl_2$ brine solution shall be applied to roads using on-site water truck using spray bar arrangement.
- The rate of $CaCl_2$ brine application should be enough to suppress dust but not sufficient to allow water to puddle or pool on the road surface.
- Ensure the application of $CaCl_2$ brine is limited to the traveled road surface.
- Be cautious applying $CaCl_2$ brine to road surfaces near watercourses or over watercourse crossings.
- The frequency or rate of $CaCl_2$ brine application will vary depending upon the prevailing site conditions and shall be determined by the Senior Construction representative on-site with consultation with the Baffinland Environmental Department representative on-site
- Only a trained operator(s) assigned and trained on the water truck operation shall be used to apply water on Mary River Project Site Roads to suppress dust on a as required basis.
- Have a spill response plan in place and a functional spill kit on each applicator and in application area.
- On a daily basis brine volume used for dust suppression shall be tracked by and reported to the Baffinland Environmental Department representative on-site.
- Ensure all equipment used on site is well maintained and free of fluid leaks.

2.3.1.5 *Storage*

- $CaCl_2$ shall be stored in accordance with applicable regulations and shall be handled with care.
- Transfer and loading of $CaCl_2$ shall occur at designated sites away from watercourses.
- Care shall be taken to avoid spilling chemicals during transfer and loading.
- Equipment and tools shall be cleaned in a designated area, if possible. Any wash water generated by cleaning tools and equipment shall be managed in a manner that will prevent its direct release to watercourses.
- Ensure all equipment used on site is well maintained and free of fluid leaks.

2.3.2 *Dust Stop Municipal Blend*

The use of Dust Stop Municipal Blend (DSMB), produced by Cypher Environmental Ltd., was first trialed in August of 2019 over a 4 km stretch (from KM 103.5 to Km 97) of the Tote Road and subsequently applied along the entire Tote Road in 2020. A representative from Cypher Environmental was onsite to instruct Road Maintenance personnel on the use and application of the product. Instructions and methods provided by Cypher Environmental were followed by Baffinland staff. Improved dust suppression was visually observed over a three-day period throughout the application zones and the product also showed signs of water shedding during rain events supporting improved road sealant and application lifespan. The Safety Data Sheet (SDS) for DSMB is provided in Attachment C.

2.3.2.1 *Application Rates for Mixing*

DSMB dust suppression product is a concentrated liquid and that needs to be mixed with water at varying concentrations for specific applications. For Project roads, three specific application rates have been identified. Application rates are based on an average road width of 11 meters.

- Initial application: For every one (1) kilometer of road length apply 5000 liters of DSMB mixed with 25,000 liters water (5 totes DSMB in a full 740 water truck tank).
- Sealer coat application: For every two (2) kilometers of road length apply 2000 liters of DSMB mixed with 28,000 liters water (2 totes DSMB in a full 740 water truck tank). Apply 24 hours after the 1st application to act as a top spray coat.
- Routine maintenance application: For every two (2) kilometers of road length apply 1000 liters of DSMB mixed with 29,000 liters of water (1 tote of DSMB in a full 740 water truck tank). Apply as a top spray coat once every two (2) weeks.

2.3.2.2 *Steps for Mixing DSMB in Water Truck Tank*

- Set up totes at mixing station to allow DSMB to drain into the mixing station tank. Remove the top lid and open the spout on the bottom of the tote to drain the DSMB.
- Fill the mixing station tank with water from the bottom fill point, taking care not to over fill the tank to allow space for the full volume of DSMB in the totes to be blended in. If required, turn the water valve off when the mixing tank reaches 50% capacity and allow the totes to completely drain.
- When the totes are empty, rinse them with water and drain the rinse water into the mixing station tank. Close the drain spout and replace the caps before placing the empty totes into the same seacan they were removed from to prepare them to be back hauled.
- Fill the mixing station tank to capacity with water and turn on the recirculation pump to improve mixing efficiency.
- Once the mixing tank is full, allow the DSMB to recirculate for 5-10 minutes and then load the 740 water truck from the mixing tank.
- When the mixing tank is empty, top up the water truck to full capacity with additional water.

2.3.2.3 *Initial Application*

- Prior to proceeding with the initial application, the Road Maintenance Supervisor will visually assess the length of the road that will be treated and mark out start and finish points.
- If using fresh gravel for the length of the road that will be treated, place material with a grader and fully cover the road way.
- If fresh gravel is only being used for spot repairs such as potholes and rough sections, place it in needed areas and spread it with the grader.
- Request the Grader Operator to pull all of the available material onto the road from the shoulders and remove windrows on either side. The Grader Operator should shape the road with a center crown as much as possible and remove larger rocks off the road surface. Make sure that the entire length of road to be treated has been graded before applying the mixed DSMB treatment.

- Utilizing the 740 water truck with a modified spray bar attached, apply the DSMB treatment to the road surface using pressurized spray from the spray bar. Align the 740 water truck at the start point of the length of road to be treated and make sure that the DSMB treatment is applied to a fresh area of the road with 1-2 meters of overlap on previously treated area of the road at the transition from treated to untreated areas.
- Starting at the edge of the road, the 740 water truck will apply DSMB treatment onto the entire width of the road in roughly eight (8) full passes. The number of passes will vary depending on the width of the road. The following steps should be taken with the 740 water truck in third gear at 1800 rpm (9 miles per hour) during application of DSMB to treat the entire width and length of each length of road to be treated:
    - Apply the first application pass at the outside edge of the road for the full length of the road to be treated.
    - Apply the second pass on the opposite edge of the road from the first pass for the full length of the road to be treated.
    - Apply the third pass with a slight overlap on the inside edge of the first pass for the full length of the road to be treated.
    - Apply the fourth pass with a slight overlap on the inside edges of the second and third passes for the entire length of the road to be treated.
    - Apply four additional passes in the same order as the previous four passes until the tank is empty to make sure that the road surface is well saturated with the DSMB treatment.
    - The Grader Operator should rework the entire length of road to mix the DSMB treatment into the road surface by grading the surface back and forth before reshaping the road surface with a center crown.
    - A grader packer attachment or tire pack with rock truck can be used to compact the road surface to improve the compaction of the treated road surface.
    - Allow the treated road surface to cure for 12-24 hours before applying the sealing coat.

2.3.2.4 *Sealing Coat Application*

- Load the 740 water truck with the prescribed mixture of DSMB and water for the sealing coat.
- Apply the sealing coat using the gravity spray bar or high mounted spray pots for wider road surface coverage of the DSMB treatment.
- After the road surface has been treated, use a grader packer attachment or rubber tired rock truck to compact the road surface to improve the compaction of the treated road surface.

2.3.2.5 *Routine Maintenance Application*

- Routine maintenance application of DSMB is recommended to be done every 2 weeks in warm dry weather. Apply DSMB to the road surface in a similar fashion as the sealing coat.

2.3.3 *EK35 Synthetic Organic Dust Control®*

EK35 synthetic organic dust control®, produced by Midwest Industrial Supply, Inc., is applied to the surface of the airstrip to prevent excessive dust mobilization when planes take off and land. The Safety Data Sheet (SDS) for EK35 is provided in Attachment D.

2.3.3.1 *Routine Application*

EK35 is applied during the summer in warm dry conditions that allow suitable curing time and to avoid product runoff from the airstrip. EK35 is applied from 1000 liter totes to the surface of the airstrip using a truck mounted eight (8) foot wide sprayer bar powered by a 4.7-hp Diesel/JP8 fuel electric start engine and Gorman-Rupp pump. During application, the product is sprayed onto the surface of the airstrip in eight (8) food wide paths with roughly 0.5-1 m of overlap between paths to make sure that the entire width of the airstrip is treated. The flow rate of EK35 to the sprayer bar is carefully regulated with the engine throttle to provide even distribution of the product.

3. References

The Government of the Nunavut, Environmental Protection Service, Department of Sustainable Development. Environmental Guideline for Dust Suppression on Unpaved Roads. Revised April 2014

Agnico Eagle Mines Ltd. – Meadowbank Division. Dust Suppression Protocol for Roads. 2008

Environmental Protection Act - Spill Contingency Planning and Reporting Regulation.

Department of Government Services and Public Works, Yellowknife, NWT, Technical Services Division. Community Dust Control Program - *Calcium Chloride as a Dust Suppressant* . 1992.

City of Albuquerque, Environmental Health Department, Air Quality Division. Fugitive Dust Control Methods. 2005

Environment Australia, Department of the Environment. Best Practice Environmental Management in Mining: Dust Control. 1998

Water, Air and Climate Change Branch, Environmental Protection Division, BC Ministry of Environment. Road salt and Winter Maintenance for British Columbia Municipalities, Best Management Practices to Protect Water Quality. 1998.

4. Attachments/Enclosure:

Attachment A - Environmental Guideline for Dust Suppression on Unpaved Roads, Government of Nunavut, Environmental Protection Service, Department of Sustainable Development (Revised April 2014).

Attachment B – SDS Sheet 'Calcium Chloride' by Sel Warwick Inc. of Victoriaville, Québec

Attachment C – SDS Sheet 'Dust Stop Municipal Blend' by Cypher Environmental Ltd. of Winnipeg, Manitoba

Attachment D – SDS Sheet 'EK35® Synthetic Organic Dust Control® (Series of Products)' by Midwest Industrial Supply, Inc. of Canton, Ohio, U.S.A.

Environmental Guideline for

Dust Suppression on Unpaved Roads

Department of Environment
Government of Nunavut

GUIDELINE: DUST SUPPRESSION ON UNPAVED ROADS

Original: January 2002
Revised: April 2014

This Guideline has been prepared by the Department of Environment's Environmental Protection Division and approved by the Minister of Environment under the authority of Section 2.2 of the *Environmental Protection Act.*

This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to increase the awareness and understanding of the risks, hazards and best management practices associated with dust suppression on unpaved roads. This Guideline does not replace the need for the owner or person in charge, management or control of dust suppressants to comply with all applicable legislation and to consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the control of dust from unpaved roads.

Copies of this Guideline are available upon request from:

Department of Environment
Government of Nunavut
P.O. Box 1000, Station 1360, Iqaluit, NU, X0A 0H0
Electronic version of the Guideline is available at http://env.gov.nu.ca/programareas/environmentprotection

Cover Photos: Top – Cypher Environmental Ltd.
Bottom – Midwest Industrial Supply Inc.

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Appendices

Introduction

All unpaved roads and other surfaces will give off dust when driven on. This dust can be a significant source of particulate matter in the atmosphere and have environmental, health and safety impacts. These may include reducing visibility along the road, increasing the risk of vehicle accidents, aggravating symptoms in individuals who suffer from respiratory diseases and impacts to aesthetics. Dust from unpaved roads can also slow the growth of plants up to 150 meters from the road edge by settling on leaves (the shading effect) and reducing photosynthesis.

Loss of fine particles can also lead to road surface damage and exposure the of larger gravel. This gravel can then be scattered by vehicles or washed away, making the road surface rough and unstable. Potholes and areas of washboard may develop which contribute to further road deterioration and travel safety issues, increased road maintenance needs and increased vehicle repair costs.

When used in accordance with manufacturers' instructions, dust suppressants can lower the environmental, health and safety impacts associated with road dust. Numerous products and techniques are available to reduce dust conditions and preserve road surfaces. In a report prepared for the federal Road Salts Working Group[1], Environment Canada describes seven broad categories of chemical dust suppression products: chloride salts and brines (i.e. calcium chloride and magnesium chloride); organic non-bituminous chemicals (i.e. lignosulfonates, sulphite pulp mill liquors, tall oil pitch, pine tar, vegetable oils, and molasses); petroleum-based binders and waste oils; electro-chemical stabilizers; various polymers; enzyme slurries; and cementitious binders. Each category of suppressant is unique with its own characteristics, benefits and limitations (i.e. toxicity, visual appearance, application rate and methods, costs).

This *Environmental Guideline for Dust Suppression on Unpaved Roads* (the Guideline) examines the most commonly used dust suppressants and the conditions under which they are most effective. It is intended to increase awareness and understanding of characteristics, benefits and hazards associated with commonly used dust suppressants and introduce best management practices to reduce dust levels from unpaved roads. It is not an official statement of the law. For further information and guidance, the owner or person in charge, management or control of dust suppressants is encouraged to review all applicable legislation and consult the Department of Environment, other regulatory agencies or qualified persons with expertise in the control of dust from unpaved roads.

The *Environmental Protection Act* enables the Government of Nunavut to implement measures to preserve, protect and enhance the quality of the natural environment. Section 2.2 of the *Act* provides the Minister of Environment with authority to develop, coordinate, and administer the Guideline.

1.1 Definitions

Approved Product	A product listed in section 3.2 *Approved Dust Suppressants* or approved by the Environmental Protection Division under section 3.5 *Approval of New Dust Suppressants*.

[1] Profile of Chloride-Based Dust Suppressants Used in Canada.

Commissioner's Land	Lands that have been transferred by Order-in-Council to the Government of Nunavut. This includes roadways and land subject to block land transfers. Most Commissioner's Land is located within communities.
Contaminant	Any noise, heat, vibration or substance and includes such other substance as the Minister may prescribe that, where discharged into the environment, (a) endangers the health, safety or welfare of persons, (b) interferes or is likely to interfere with normal enjoyment of life or property, (c) endangers the health of animal life, or (d) causes or is likely to cause damage to plant life or to property.
Dust Suppressant	Any treatment material for reducing dust emissions.
Environment	The components of the Earth and includes (a) air, land and water, (b) all layers of the atmosphere, (c) all organic and inorganic matter and living organisms, and (d) the interacting natural systems that include components referred to in paragraphs (a) to (c) above.
Inspector	A person appointed under subsection 3(2) of the *Environmental Protection Act* and includes the Chief Environmental Protection Officer.
Roadway	The travelled surface of a road from shoulder to shoulder, but does not include the side slopes or ditches of the road.
Used Oil	Engine, turbine and gear lubricating oil, hydraulic and transmission fluid and insulating coolant (i.e. transformer fluid) that is unsuitable for its intended purpose due to the presence of impurities or the loss of original properties, but does not include waste derived from animal or vegetable fat or a petroleum product spilled on land or water.
Waste Fuel	A flammable or combustible petroleum hydrocarbon that is unsuitable for its intended purpose due to the presence of impurities or the loss of original properties, and includes gasoline, diesel and fuel oil, aviation fuel, kerosene and naphtha, but does not include paint, solvent or propane.

1.2 Roles and Responsibilities

1.2.1 Owners and Applicators of Dust Suppressants

Owners or persons in charge, management or control of a chemical dust suppressant, also referred to as the Responsible Party, and applicators must ensure the chemical is properly and safely managed from the time it is purchased to its final use or disposal. This includes community, territorial and federal government, commercial, industrial and institutional operators and any person who may own or possess chemical dust suppressants.

Contractors may manage and apply dust suppressants on behalf of the Responsible Party. However, the Responsible Party remains liable for ensuring the contractor complies with all applicable statutes, regulations, standards, guidelines and community by-laws. If the contractor does not comply with the requirements of the *Environmental Protection Act* and is charged with a violation while managing or applying the dust suppressant, the Responsible Party may also be charged.

If a dust suppressant becomes contaminated, expires or otherwise becomes unsuitable for its intended purpose, it may be categorized and managed as a hazardous waste. Information on the management of hazardous waste and the registration of generators, carriers, receivers and hazardous waste management facilities can be obtained by referring to the *Environmental Guideline for the General Management of Hazardous Waste*.

1.2.2 Government of Nunavut

Department of Environment

The Department of Environment's Environmental Protection Division is the key territorial agency with responsibility for ensuring Nunavut's natural environment is protected. Authority is derived from the *Environmental Protection Act*, which prohibits the discharge of contaminants to the environment and enables the Minister to undertake actions to ensure appropriate management measures are in place. Although programs and services are applied primarily to activities taking place on Commissioner's and community lands and to Government of Nunavut undertakings, the *Environmental Protection Act* may be applied to the whole of the territory where other controlling legislation, standards and guidelines do not exist. A complete listing of relevant legislation and guidelines can be obtained by contacting the Department or by visiting the web site at http://env.gov.nu.ca/programareas/environmentprotection.

The *Environmental Guideline for Ambient Air Quality* sets standards for maximum levels of dust in ambient air. The standard for fine particulate matter[2] measured over a 24 hour period is 30 micrograms per cubic meter (µg/m^3) while the standard for total suspended particulate[3] measured over a 24 hour period is 120 µg/m^3. These standards apply to the whole of Nunavut. They are used to assess the impact dust levels may have on the environment, facilitate regional air quality management planning and establish benchmarks for reporting on the state of air quality. A copy of the *Environmental Guideline for Ambient Air Quality* can be downloaded from the Department's web site at http://env.gov.nu.ca/node/82#Guideline Documents.

Workers' Safety and Compensation Commission

The Workers' Safety and Compensation Commission is responsible for promoting and regulating worker and workplace health and safety in Nunavut. The Commission obtains its authority from the *Workers' Compensation Act* and *Safety Act* which require an employer to maintain a safe workplace and ensure the safety and well being of workers. The Workplace Hazardous Materials Information System, or WHMIS, requires information be provided to workers on the safe use of any hazardous material used in the workplace.

[2] Fine particulate matter consists of extremely fine particles and droplets with a diameter of less than 2.5 microns (one micron equals one millionth of a meter).
[3] Commonly referred to as airborne dust or dirt, total suspended particulate consists of airborne particles or droplets that have a diameter of up to 100 microns.

Department of Health and Social Services

Activities related to the handling, storage, transportation, application and disposal of dust suppressants may have an impact on public health. The Office of the Chief Medical Officer of Health and Regional Environmental Health Officers should be consulted regarding legislated requirements under the *Public Health Act.*

Department of Community and Government Services

The Department of Community and Government Services is responsible under the *Commissioner's Lands Act* for issuing land leases, reserves, licenses and permits on Commissioner's Lands. The Department, in cooperation with community governments, is also responsible for planning and funding solid waste and sewage disposal facilities in most Nunavut communities. The Department's emergency planning responsibilities under the *Emergency Measures Act* include developing territorial emergency response plans, coordinating emergency operations at the territorial and regional levels and supporting community emergency response operations.

The Office of the Fire Marshal is responsible for ensuring the safe storage, handling and use of flammable and combustible liquids and materials and obtains its authority from the *Fire Prevention Act*, *National Fire Code* and *National Building Code*.

Department of Economic Development and Transportation

The Airports Division of the Department of Economic Development and Transportation is responsible for the safe, efficient and effective management and operation of airports in Nunavut including the maintenance of runways and airport terminal aprons. The Motor Vehicles Division is responsible for the safe transport of dangerous goods and hazardous waste by road through administration of the *Transportation of Dangerous Goods Act*.

1.2.3 Government of Canada

Environment Canada

Environment Canada is responsible for administering the *Canadian Environmental Protection Act* (CEPA). In 1995, chloride-based dust suppressants were placed on the Government of Canada's Priority Substances List 2 for assessment to determine their toxicity under the CEPA. The resulting scientific assessment concluded road salts pose a serious threat to the aquatic environment, plants and animals due to high releases around storage and snow disposal sites and run-off from roadways into soils, streams and rivers.

Environment Canada also regulates the interprovincial and international movement of hazardous waste under the *Interprovincial Movement of Hazardous Waste Regulations* and *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations.* It is also responsible for administering the pollution prevention provisions of the federal *Fisheries Act*.

Aboriginal Affairs and Northern Development Canada

Aboriginal Affairs and Northern Development Canada is responsible under the *Territorial Lands Act* and *Nunavut Waters and Nunavut Surface Rights Tribunal Act* for the management of federal lands and waters, including the impact dust suppressants may have on the quality of these lands and waters.

1.2.4 Community Governments and Co-management Boards

Local Community Governments

Community governments perform an important role in the proper management of dust suppressants. In addition to being major users of dust suppressants, community governments are entitled under the Nunavut Land Claims Agreement to control their own community landfill site and sewage lagoon. Unwanted dust suppressants may be deposited into landfills and sewage lagoons only with the consent of the local community government. The local fire department may also be called upon if a fire or other public safety issue involving chemical dust suppressants is identified.

Co-management Boards and Agencies

Co-management boards and agencies established under the Nunavut Land Claims Agreement have broad authority for land use planning, impact assessment and the administration of land and water. Activities involving the management and use of dust suppressants may be controlled through setting terms and conditions in plans, permits and licenses issued by the Nunavut Water Board, Designated Inuit Organizations responsible for land administration and other co-management boards and agencies.

Overview of Dust Suppressants

2.1 Dust Suppression Products and Alternatives

There are many different methods which can be used to control dust from unpaved roads. It is best to choose a method that will be most effective and economical. When planning a dust suppression program, the dust suppressant material or technique should be:

- Environmentally safe
- Easily applied using locally available road maintenance equipment
- Workable and responsive to maintenance activities
- Reasonably effective at controlling dust
- Not degrading to ride quality or use of the road
- Relatively harmless to vehicles using the road
- Posing little hazard or inconvenience to users of the road and adjacent residents
- Cost effective

The most commonly used dust suppressants are water, chloride salts, asphalt products and lignins. The general characteristics of these and other treatments used to control dust on unpaved roads are described in this section.

Water

Water is the most commonly used dust control agent. Water wets the road surface and binds fine particles together by the surface tension of the water. While water is readily available, low cost and easy to apply, it evaporates quickly and generally controls dust for less than 12 hours. Seawater is more effective for controlling dust than freshwater but repeated applications and long-term use may harm nearby vegetation and freshwater aquatic life.

Chloride Salts

Calcium chloride and *magnesium chloride* are the two most commonly used chemical dust suppressants. They are hygroscopic, or water attracting, agents that increase the moisture content of the road surface by attracting moisture from the air. This helps form a crusty layer which holds the fine particles on the road surface. Usually one to two treatments is required each year to maintain effective dust control.

Lignins and Petroleum Products

Lignosulfonate, a residue of paper production, and *petroleum products* is the other major group of chemical dust suppressants. Unlike chloride salts, these materials are adhesives and binders that physically glue soil particles together. These form a hard crust and are waterproof which helps to protect and stabilize the road surface. Lignin derivatives usually require one or two treatments each year and can create low dissolved oxygen conditions that are harmful to aquatic life if a spill or runoff from the road surface is allowed to enter adjacent rivers or lakes. A wide range of petroleum products (i.e. bitumens, tar and resins) are commercially available in Canada for dust suppression. Their effectiveness, safe use and environmental risks vary widely.

Other Dust Suppressants

Electro-chemical stabilizers attract positively charged dust particles and bind ionically to them. They also expel absorbed water and aid in compaction of the road surface. While a large variety of these materials are commercially available, their performance can be variable and pilot tests should be performed

before large-scale applications take place. *Polymers* are composed of long-chained molecular structures and bind road particles together to form a semi-rigid film on the road surface. These suppressants are usually more expensive than competitive road surface treatments and are most effective on lightly trafficked surfaces. *Enzyme slurries* promote compaction and have been effective in reducing dust under highly specific trafficked surfaces and gravel conditions. *Cementitious binders* work to chemically and permanently bind soil particles together.

Refer to Appendix 2 *Comparison of Dust Suppressant Characteristics* for more details on these and other dust suppressants.

2.2 Potential Effects of Chemical Dust Suppressants on the Environment and Human Health

There are no environmental hazards associated with the use of freshwater as a dust suppressant if it is not applied excessively. Repeated applications and long-term use of seawater may however, impact nearby vegetation and aquatic life as it contains small quantities of chloride salts.

Chloride salts are not toxic to humans at low concentrations. Domestic pets (i.e. dogs) can however, develop drooling, vomiting and diarrhea from ingesting road salts either by eating them directly or licking salty paws. Exposure of a dog's paws to road salt can also produce painful irritations, inflammation and cracking of the feet pads. The most visible impact of road salt on the environment is on plants along treated roadways. Stress and dehydration caused by salt can result in foliage damage and reductions in seed germination and flowering. Elevated levels of chloride salt in soil can also cause a colonization of salt tolerant plant species such as cattails, thereby reducing plant diversity. In addition, elevated chloride levels can be toxic to many forms of freshwater fish and aquatic insects.

Lignosulfonates are low in toxicity based on results of tests in laboratory animals including rats, rabbits and guinea pigs. The primary environmental concern from lignosulfonate use comes from its high solubility in water and high biological oxygen demand. Dissolved oxygen will be removed from waterways during lignosulfonate decomposition to levels that may be harmful to fish and other aquatic organisms. Allowing these products to enter waterways can also result in foaming and discoloration.

The potential effects of petroleum products and petroleum-derived dust suppressants on the environment and human health is directly related to their physical properties and the types and levels of contaminants present. While petroleum-derived dust suppressants generally have a low volatility, inhaling the more volatile components can cause irritation and inflammation of the throat and lungs. Prolonged or repeated skin contact may cause irritation and dermatitis, and should be avoided.

Used oil was once commonly used as a dust suppressant in Nunavut but now its use is strictly prohibited. During its use in engines, lubricating oil can become contaminated with by-products of combustion from engine wear. These contaminants include cancer-causing polycyclic aromatic hydrocarbons (PAHs) and metals (i.e. aluminum, cadmium, chromium, lead and copper). When used oil is applied to a road surface, these contaminants can bind to dust particles and then be washed off the road by rainfall or get blown into the air by traffic and wind. People and animals may swallow these harmful chemicals and metals through drinking water, breathing in contaminated air or dust, or eating contaminated berries or vegetation.

Best Management Practices

3.1 Pollution Prevention

Pollution prevention involves methods and practices that minimize or eliminate the generation of waste. Employing these methods only makes good sense as they help to reduce the hazards and costs associated with handling, storing, transporting, recycling, treating and disposing of any resulting waste. Implementing pollution prevention methods and practices also helps to reduce impacts on the environment, human and worker health and safety and minimize the use of raw materials.

Owners of dust suppressants can help prevent pollution and reduce costs by implementing a range of waste reduction, reuse and recycling initiatives. These include changes to operational procedures, maintenance practices and raw material use. Several of these initiatives are identified below.

Reduce

- Purchase the right type of dust suppressant and only the amount needed
- Use what you purchase
- Develop effective inventory controls and ensure the stored dust suppressants are completely used before purchasing additional supplies
- Establish and maintain storage methods and schedules that are consistent with those suggested by the manufacturer or supplier

Reuse and Recycling

- Donate unused dust suppressant to reputable local companies or individuals
- Make an agreement with your supplier to return un-opened and undamaged containers or packages of dust suppressants

There are also several practical alternatives to dust suppressants that will help reduce the level of dust from unpaved roads. Table 1 describes several of these alternatives.

Table 1.

	Description
Reducing Traffic	Reducing the number of vehicles on the road can reduce dust. Traffic can be reduced voluntarily by encouraging people to walk. Alternatively, limiting vehicle access to certain unpaved roads and paths will reduce dust levels.
Reducing Speed	Fast moving vehicles result in more dust than slow moving vehicles. Reducing speed from 60 kilometers per hour to 30 kilometers per hour can reduce dust by as much as 65%. Speed limit signs, enforcement and awareness can reduce vehicle speeds.
Improving Road Design	Good road design and drainage can reduce dust. When a road has poor drainage, water in puddles floats the fine particles up from the soil beneath the road. Traffic and wind can then spread the dry fine particles as dust.
Reducing Exposed Ground	Covered ground does not blow away and create dust. Covering the road surface with gravel can reduce the levels of dust from unpaved roads.
Slowing the Wind	Windbreaks are barriers designed to slow the speed and direction of wind. Methods may include leaving snow fences stand in place during the summer and maintaining vegetation along ATV paths.

3.2 Approved Dust Suppressants

Industrial suppliers offer many different products for controlling dust on unpaved roads. Each product has its own environmental, safety and operational benefits and limitations. The following dust suppressants are currently approved for use in Nunavut:

Freshwater and sea water
Calcium chloride
DL 10
EK-35
DUST-STOP

Refer to appendix #3 *Approved Dust Suppressants* for information on these approved products.

Dust suppressants may only be used on unpaved roads in Nunavut if they are listed as an 'approved dust suppressant' or have been approved for use by the Nunavut Department of Environment or through the setting of terms and conditions in plans, permits and licenses issued by the Nunavut Water Board or a Designated Inuit Organization responsible for land administration. Refer to section 3.5 *Approval of New Dust Suppressant Products* for information on the assessment and approvals process.

Used oil and waste fuel are strictly prohibited from use as dust suppressants on unpaved roads.

3.3 General Application Procedures for Approved Dust Suppressants

Regardless of the dust suppressant used, there are general application procedures which should be followed when planning or undertaking any dust suppression program in Nunavut. Table 2 describes these general procedures.

Table 2.

	General Application Procedures
Manufacturer's Directions	The manufacturer's specifications, directions and other procedures must be followed at all times. Where the dust suppressant is a manufactured product, these specifications and directions are available through the supplier.
Notification	The general public or other users of the road should be notified at least 24 hours before any application is scheduled to begin. This notification can be through the use of temporary road signs, public notices and local media announcements. The local office of the territorial Department of Environment should be provided with information on the dust suppressants to be used, location and schedule of work. If a dust suppressant is to be applied on private property, a written agreement should be entered into between the property owner and the applicator.

When to Apply	Dust suppressants generally work best when applied to damp road surfaces. If the road surface is dry, a water truck can be used to dampen the road before applying the suppressant. Caution should be undertaken when applying chloride salts and lignosulphonates because they are soluble and can be leached out of a road by excess water. Soluble suppressants should not be applied when it is raining or if rain is forecast in the next few days.
How to Apply	The road surface should be tested to ensure proper gradation. The dust suppressant should not pool on the surface due to depressions in the road surface or run off the traveled area because of excessive surface slope. If the road surface is tight and penetration of the liquid suppressant is poor, the top one to two inches of road surface should be loosened or scarified before applying the dust suppressant. Application equipment should be accurately calibrated and the suppressant applied evenly across the road surface. The amount of dust suppressant should not exceed the minimum amount required to effectively suppress dust. The dust suppressant should be bladed or incorporated into the road surface immediately following its application. This helps to ensure the product is incorporated into the surface materials and does not migrate off the roadway. It is ideal to keep traffic off the road for up to two hours after application has been completed. Avoid applying dust suppressant when heavy vehicle traffic is expected (i.e. immediately before or after regular office hours). If this is not possible, then only one side of the road should be treated at a time and traffic diverted. This will help to minimize the spreading of dust suppressant by vehicles and protect vehicles from metal corrosion.
Where to Apply	The application must be limited to the roadway or parking lot surface. Carefully monitor the application rate to ensure adequate coverage is achieved without any runoff of the product. Limit the application of dust suppressants near open bodies of water (i.e. lakes and streams) to prevent runoff or leachate from entering the water. Never apply a dust suppressant to areas of roads that are subject to flooding.
Cleaning of Equipment	The application equipment should be cleaned immediately following use when using chloride salts due to their corrosive nature.
Reworking the Road Surface	Many dust suppressants allow the road surface to be periodically reworked to remove potholes and ruts. Grading should never exceed the depth of the suppressant to avoid its dilution with untreated gravel and sand.
Test Sections	It is sometimes difficult to predict what level of performance will be achieved through the use of a dust suppressant. It is advisable to test the suppressant on a small portion of the road when the product is being applied for the first time.

3.4 Spill Response and Cleanup

Spills of chemical dust suppressants can affect soil, groundwater and surface water quality if they are not cleaned up quickly and properly. Be prepared to respond to accidental spills. Spill contingency plans

should be developed by the person in charge, management or control of any chemical dust suppressant. All spills of hazardous materials must immediately be reported to the NWT/Nunavut 24-Hour Spill Report Line at (867) 920-8130 in accordance with the *Spill Contingency Planning and Reporting Regulations*.

3.5 Approval of New Dust Suppressants

Dust suppressants may only be used if they have either been listed as an 'approved dust suppressant' (refer to section 3.2 *Approved Dust Suppressants*) or been approved for use by the Nunavut Department of Environment or through the setting of terms and conditions in plans, permits and licenses issued by the Nunavut Water Board or a Designated Inuit Organization responsible for land administration.

To enable new dust suppressants to be assessed, specific information should be provided to the Environmental Protection Division of the Department of Environment no later than 30 calendar days before the dust suppression program is scheduled to begin. Table 3 describes the type of information needed to assess new dust suppressants. The submission of incomplete information may result in delays in obtaining the necessary approval.

Table 3.

	Information Requirements
Product Information	Manufacturer's product information (including toxicity and solubility) and Material Safety Data Sheet
Procedures	Manufacturer's Standard Operating Procedures (SOP) for the handling, storage and application of the dust suppressant
Laboratory Testing	Results of the Toxicity Characteristic Leaching Procedure[4] if the dust suppressant and road material forms a solid substance following application
Schedule and Location	Schedule for applying dust suppressant to road test sections and its full application. Include a map of the area to be treated including location of any sensitive environments (i.e. lakes, streams, rivers), homes and businesses
Other Information	Copies of regulatory approvals from other Canadian jurisdictions, Boards and agencies; and accounts of product effectiveness and subsequent durability of the treated road surface

[4] The recommended leachate testing procedure is the United States Environmental Protection Agency Toxicity Characteristic Leaching Procedure (TCLP) Test Method 1311. The procedure is designed to assess the mobility of organic and inorganic analytes by simulating material residing inside a landfill containing unsegregated waste. Any leachate collected from the test must then be analyzed using methods contained in the most recent edition of *Standard Methods for the Examination of Water and Wastewater.* Analysis must be conducted by a laboratory that has been formally recognized by the Canadian Association of Environmental Analytical Laboratories (CAEAL) as being competent to perform the specified tests.

Conclusion

Dust from unpaved roads can have environmental and public heath and safety impacts. Use of chemical and non-chemical dust suppressants can be effective in reducing the impacts of fugitive dust by minimizing the loss of fine particles to the air and stabilizing the road surface. Numerous products and techniques are available, each with its own characteristics (i.e. toxicity and solubility), benefits and limitations. This Guideline examines the most commonly used dust suppressants and the conditions under which they are most effective. It is intended to increase the awareness and understanding of the characteristics, benefits and hazards associated with dust suppressants and introduce the reader to best management practices which, when safely and properly applied, can reduce the impacts of dust suppressants and minimize fugitive dust levels from unpaved roads.

Familiarity with the Guideline does not replace the need for the owner or person in charge, management or control of dust suppressants to comply with all applicable federal and territorial legislation and community by-laws. The management of these products may also be controlled through permits and licenses issued by Nunavut's co-management boards, Aboriginal Affairs and Northern Development Canada and other regulatory agencies. These permits and licenses must be complied with at all times.

For additional information on the management of dust suppressants in Nunavut, or to obtain a list of available guidelines, go to the Department of Environment web site or contact the Department at:

Environmental Protection Division
Department of Environment
Government of Nunavut
Inuksugait Plaza, P.O. Box 1000, Station 1360
Iqaluit, Nunavut X0A 0H0

Telephone: (867) 975-7729
Fax: (867) 975-7739
Email: EnvironmentalProtection@gov.nu.ca
Website: http://env.gov.nu.ca/programareas/environmentprotection

References

Alaska Department of Environmental Conservation. Top Ten Dust Control Techniques. http://dec.alaska.gov/air/anpms/Dust/topten_dustctrl2.htm#improvingroaddesigns

Agnico-Eagle Mines Ltd. Meadowbank Division. Dust Suppression Protocol for the Meadowbank Gold Mine Site Roads and the all Weather Access Road to Baker Lake. 2008 http://ftp.nirb.ca/03-monitoring/03MN107-MEADOWBANK%20GOLD%20MINE/01-PROJECT%20CERTIFICATE/FOLLOW-UP/CONDITION%2074/080710-Technical%20Memo%20RE%20Dust%20Suppression-IT4E.pdf

Environment Canada. Best Practices for the Use and Storage of Chloride-Based Dust Suppressants. http://www.ec.gc.ca/nopp/roadsalt/reports/chlorideBP/en/p3.cfm

Environment Canada. Code of Practice for the Environmental Management of Road Salts. EPS1/CC/5. 2004. http://www.ec.gc.ca/nopp/roadsalt/cop/pdf/1774_EngBook_00.pdf

Environment Canada. Profile of Chloride-Based Dust Suppressants Used in Canada. http://www.ec.gc.ca/nopp/roadsalt/reports/en/profile.cfm

Federation of Canadian Municipalities. Roads and Sidewalks: Dust Control for Unpaved Roads. 2005. http://www.fcm.ca/Documents/reports/Infraguide/Dust_Control_for_Unpaved_Roads_EN.pdf

Government of Nunavut. Consolidation of Regulation R-068-93 Spill Contingency Planning and Reporting Regulations. 1993. http://env.gov.nu.ca/sites/default/files/Spill%20Planning%20and%20Reporting%20Regs.pdf

Government of Nunavut Department of Environment. Environmental Guideline for Ambient Air Quality. http://env.gov.nu.ca/sites/default/files/guideline_-_ambient_air_quality_2011.pdf

Government of Nunavut Department of Environment. Environmental Guideline for the General Management of Hazardous Waste. 2010. http://env.gov.nu.ca/sites/default/files/Guideline%20-%20General%20Management%20of%20Hazardous%20Waste%20(revised%20Oct%202010).pdf

Material Safety Data Sheet: Calcium Chloride. Anachemia http://www.anachemia.com/msds/english/1946.pdf

Material Safety Data Sheet: EK-35. Midwest Industrial Supply Inc. http://www.midwestind.com/assets/files/MSDS/ek35%202112.pdf

Material Safety Data Sheet: DUST STOP. Cypher Environmental Ltd. http://www.eco-infrastructuresolutions.com/web_documents/cypher_dust_stop_concentrate_msds_03.07.2012.pdf

University of Wisconsin-Madison. Transportation Bulletin #13: Dust Control on Unpaved Roads. 1997. http://epdfiles.engr.wisc.edu/pdf_web_files/tic/bulletins/Bltn_013_DustControl.pdf

APPENDICES

APPENDIX 1 - *ENVIRONMENTAL PROTECTION ACT*

The following are excerpts from the *Environmental Protection Act*

1. "Contaminant" means any noise, heat, vibration or substance and includes such other substance as the Minister may prescribe that, where discharged into the environment,
   (a) endangers the health, safety or welfare of persons,
   (b) interferes or is likely to interfere with normal enjoyment of life or property,
   (c) endangers the health of animal life, or
   (d) causes or is likely to cause damage to plant life or to property;

   "Discharge" includes, but not so as to limit the meaning, any pumping, pouring, throwing, dumping, emitting, burning, spraying, spreading, leaking, spilling, or escaping;

   "Environment" means the components of the Earth and includes
   (a) air, land and water,
   (b) all layers of the atmosphere,
   (c) all organic and inorganic matter and living organisms, and
   (d) the interacting natural systems that include components referred to in paragraphs (a) to (c).

   "Inspector" means a person appointed under subsection 3(2) and includes the Chief Environmental Protection Officer.

2.2 The Minister may
   (a) establish, operate and maintain stations to monitor the quality of the environment in the Territories;
   (b) conduct research studies, conferences and training programs relating to contaminants and to the preservation, protection or enhancement of the environment;
   (c) develop, co-ordinate and administer policies, standards, guidelines and codes of practice relating to the preservation, protection or enhancement of the environment;
   (d) collect, publish and distribute information relating to contaminants and to the preservation, protection or enhancement of the environment:

3. (1) The Minister shall appoint a Chief Environmental Protection Officer who shall administer and enforce this Act and the regulations.

   (2) The Chief Environmental Protection Officer may appoint inspectors and shall specify in the appointment the powers that may be exercised and the duties that may be performed by the inspector under this Act and regulations.

5. (1) Subject to subsection (3), no person shall discharge or permit the discharge of a contaminant into the environment.

   (3) Subsection (1) does not apply where the person who discharged the contaminant or permitted the discharge of the contaminant establishes that
   (a) the discharge is authorized by this Act or the regulations or by an order issued under this Act or the regulations;
   (b) the contaminant has been used solely for domestic purposes and was discharged from within a dwelling house;
   (c) the contaminant was discharged from the exhaust system of a vehicle;

(d) the discharge of the contaminant resulted from the burning of leaves, foliage, wood, crops or stubble for domestic or agricultural purposes;
(e) the discharge of the contaminant resulted from burning for land clearing or land grading;
(f) the discharge of the contaminant resulted from a fire set by a public official for habitat management of silviculture purposes;
(g) the contaminant was discharged for the purposes of combating a forest fire;
(h) the contaminant is a soil particle or grit discharged in the course of agriculture or horticulture; or
(i) the contaminant is a pesticide classified and labelled as "domestic" under the *Pest Control Products Regulations* (Canada).

(4) The exceptions set out in subsection (3) do not apply where a person discharges a contaminant that the inspector has reasonable grounds to believe is not usually associated with a discharge from the excepted activity.

5.1. Where a discharge of a contaminant into the environment in contravention of this Act or the regulations or the provisions of a permit or license issued under this Act or the regulations occurs or a reasonable likelihood of such a discharge exists, every person causing or contributing to the discharge or increasing the likelihood of such a discharge, and the owner or the person in charge, management or control of the contaminant before its discharge or likely discharge, shall immediately:
(a) subject to any regulations, report the discharge or likely discharge to the person or office designated by the regulations;
(b) take all reasonable measures consistent with public safety to stop the discharge, repair any damage caused by the discharge and prevent or eliminate any danger to life, health, property or the environment that results or may be reasonably expected to result from the discharge or likely discharge; and
(c) make a reasonable effort to notify every member of the public who may be adversely affected by the discharge or likely discharge.

6. **(**1) Where an inspector believes on reasonable grounds that a discharge of a contaminant in contravention of this Act or the regulations or a provision of a permit or license issued under this Act or the regulations has occurred or is occurring, the inspector may issue an order requiring any person causing or contributing to the discharge or the owner or the person in charge, management or control of the contaminant to stop the discharge by the date named in the order.

7. (1) Notwithstanding section 6, where a person discharges or permits the discharge of a contaminant into the environment, an inspector may order that person to repair or remedy any injury or damage to the environment that results from the discharge.

(2) Where a person fails or neglects to repair or remedy any injury or damage to the environment in accordance with an order made under subsection (1) or where immediate remedial measures are required to protect the environment, the Chief Environmental Protection Officer may cause to be carried out the measures that he or she considers necessary to repair or remedy an injury or damage to the environment that results from any discharge.

APPENDIX 2 – COMPARISON OF DUST SUPPRESSANT CHARACTERISTICS

Dust Suppressant	Properties	Limitations	Applications	Sources
Freshwater	Moisture wets surface particles binding them together by the surface tension of the water. * Usually readily available. * Low cost. * Easy to apply.	Evaporates easily. Usually controls dust for less than 12 hours.	Usually effective for less than 12 hours.	Freshwater lakes, rivers and streams.
Salt Water	Moisture stabilizes fines. * Contains small quantities of salt (mostly magnesium chloride) which retain moisture in road. * Usually readily available. * Low cost. * Easy to apply.	Evaporates easily. Usually controls dust for one day.	Usually effective for one day.	Sea.
Calcium Chloride	Starts to absorb water from air at 29% relative humidity (25^{o}C). * Reduces rate of evaporation 3.4 times. * Significantly increases surface tension of water film between particles. * Lowers freezing point of water solution to -50^{o}C, minimizing frost heave. * Treated road can be regraded and recompacted with less concern for losing moisture and density.	Corrosive to steel and aluminum. * Rainwater tends to infiltrate road surface and leach out highly soluble chlorides. * During dry periods upward capillary action may cause chlorides to crystallize near surface where they can be leached away by rain. * Low cementing action. Effective only with well graded, stable road surfaces. * Spills may kill or burn vegetation.	Typically 2 treatments per year. * Must be stored airtight or in buildings with solid floors and protected from wet, humid conditions. * Significant heat released when mixed with water. * Spread by tank trucks with pressure distributors and spinner disk.	Byproduct brine from manufacture of sodium carbonate and bromines from natural brines. * Three forms: flake, pellet and clear liquid.
Magnesium Chloride	Starts to absorb water from air at 32% relative humidity (25^{o}C). * Reduces rate of evaporation 3.1 times. * Increases surface tension more effectively than calcium chloride solutions. * Results in very hard road surface. * Lowers freezing point of water solution to -27^{o}C (22% solution). * Treated road can be regraded and recompacted with less concern for losing moisture and density.	Very corrosive to steel in concentrated solutions. Some products may contain corrosion-inhibiting additive. * Rainwater tends to infiltrate road surface and leach out highly soluble chlorides. On roads with proper crown, most water is deflected into ditches. * During dry periods upward capillary action may cause chlorides to crystallize near surface where they can be leached away by rain.	Typically 2 treatments per year. * Storage and handling same as for calcium chloride. * Applied preferably with pressure bars as splash bars apply unevenly.	Occurs naturally as brine (evaporated). Also byproduct of potash production. * Usually liquid form, 25%-35% solution.

Dust Suppressant	Properties	Limitations	Applications	Sources
Bitumens, Tars and Resins	Binds soil because of asphalt's adhesive properties. * Waterproofs road. * May be adapted to suit wide range of soils, gravels and traffic conditions.	***Use of waste oil is prohibited in Nunavut***. * May not maintain resilience under dry conditions. Can form a crust and fragment under heavy traffic loads.	Generally 1-2 treatments per year. * 0.1 to 1.0 gallons/sq yard depending on road surface condition and dilution. * Sprayed using many different types of equipment: hand-held hoses to asphalt distributors.	Tars (coal residues) and bitumens (crude oil residues) combined with water and emulsifier or lighter distillate.
Lignosulphonate and Processed Lignin Products	Greatly increases dry strength of soil similar to 3 inches of asphalt. Outperforms bituminous binders under dry conditions. * During rain, disperses clay which in turn swells and plugs pores, reducing water penetration. * Tends to stay slightly plastic, permitting reshaping and additional traffic compaction.	Control depends on well graded soil-aggregate mix, loosened to a depth of 1-2 inches just before initial application. Silt and clay content of road surface needs to be 4-8%. * High acidity of unprocessed liquor may cause corrosion of aluminum and has potential to discolour paint or other surfaces. * Surface binding action may be destroyed by heavy rain because of solubility of solids. * Slippery when wet. Brittle when dry. * Temporary strong odour.	Generally 1-2 treatments per year. * 0.5 to 1.0 gallons/sq yard at 10-25% solution. 0.5 kg to 1.0 kg/sq yard when in powder form.	Water liquor of papermaking industry. Contains lignin (the natural cement that binds wood fibers) and carbohydrates in solution. Composition depends on raw materials and chemicals used to extract wood cellulose.

Source: Adopted from Wisconsin Transportation Bulletin #13: Dust Control on Unpaved Roads.

APPENDIX 3 – APPROVED DUST SUPPRESSANTS

Calcium Chloride

Calcium chloride is the most commonly used chemical dust suppressant in Canada. Environment Canada estimates that 98,000 tonnes of calcium chloride was used for dust suppression in 2000. Calcium chloride is hygroscopic, or water attracting, and increases the moisture content of the road surface by attracting moisture from the air. As the humidity increases, more moisture is absorbed by the solution. This helps form a crusty layer which holds the fine particles into the road surface. Calcium chloride also lowers the freezing point of moisture in the road thereby delaying freezing of the road surface in winter.

Calcium chloride is corrosive to steel and aluminum and may be toxic to aquatic organisms if allowed to enter freshwater lakes, rivers and streams. It is a skin and eye irritant in concentrated form. Skin should immediately be flushed with plenty of water after contact.

This type of dust control is normally used for lower traffic areas. Usually one to two treatments is required each year to maintain effective dust control. Calcium chloride is available in three forms: flake, pellet and clear liquid.

DL 10

DL 10 is an asphalt product that is mixed with water and a soap solution prior to its application on a road surface. Treated areas may be visually unappealing, odourous and very sticky immediately following its application. DL 10 should be applied to one side of the road at a time, and allowed to set for approximately three hours before vehicles travel on the treated surface. A pilot car or road attendants may be required to direct traffic during its application and until it has set.

Fresh DL 10 can be washed off using soap and water. A petroleum-based solvent may be required if it is allowed to dry.

EK-35[5]

EK-35 is a synthetic organic dust control product that binds surface aggregate and fine particles together. It is applied to the road surface without mixing with any other substance. Weather is not a significant consideration in its application as EK-35 will not wash away with precipitation. Application to the road surface by sprayer should be in one continuous operation to ensure a consistent finish. Multiple passes may be required to achieve a desired finish. EK-35 can be re-worked (i.e. graded) without re-application.

EK-35 is non-flammable but will burn on prolonged exposure to flame or high temperature. It can be stored indefinitely and will not freeze. Although toxicity levels are low, eye protection and protective clothing should be provided to workers to minimize skin contact.

[5] Registered trade name is “EK-35 Synthetic Organic Dust Control”

DUST-STOP

DUST-STOP is a proprietary modified cellulose blend made up of two primary constituents: a mineral based component and a starch based polymer derivative. The dust control efficacy of the product comes from the polymer which forms a cross linking molecular chain when mixed with water that binds to road particles. The mineral component is added to act as filler between the polymer particles, otherwise the product would gel before it could be applied to the road surface.

DUST-STOP is an odourless white to off-white free-flowing powder. While it is nonirritating to eyes and skin, safety glasses and clean body-covering clothing should be worn by workers. DUST-STOP is non-toxic except when ingested in relatively large amounts. It should be stored in a dry place at temperatures below 32 ^{o}C.

APPENDIX 4 – GOVERNMENT CONTACTS

Government of Nunavut

Environmental Protection Division
Department of Environment
Inuksugait Plaza
P.O. Box 1000, Station 1360
Iqaluit, Nunavut X0A 0H0
Telephone: (867) 975-7729
Fax: (867) 975-7739

Motor Vehicles Division
Department of Economic Development and Transportation
P.O. Box 10, NCC Building
Gjoa Haven, Nunavut X0B 1J0
Telephone: (867) 360-4615
Fax: (867) 360-4619

Workers' Safety and Compensation Commission
Qamutiq building, 2nd Floor
611 Queen Elizabeth Way
P.O. Box 669
Iqaluit, Nunavut X0A 0H0
Telephone: 1-877-404-4407 (toll free)
Fax: 1-866-979-8501

Department of Community and Government Services (all Divisions)
P.O. Box 1000, Station 700
4th Floor, W.G. Brown Building
Iqaluit, Nunavut X0A 0H0
Telephone: (867) 975-5400
Fax: (867) 975-5305

Office of Chief Medical Health Officer of Health
Department of Health and Social Services
P.O. Box 1000, Station 1000
Iqaluit, Nunavut X0A 0H0
Telephone: (867) 975-5743

Government of Canada

Aboriginal Affairs and Northern Development Canada
P.O. Box 2200
Iqaluit, Nunavut X0A 0H0
Telephone: (867) 975-4500
Fax: (867) 975-4560

Environment Canada (NWT and Nunavut)
5019 52nd Street
P.O. Box 2310
Yellowknife, Northwest Territories X1A 2P7
Telephone: (867) 669-4730
Fax: (867) 669-6831

Fisheries and Oceans Canada – Eastern Arctic Area
4th Floor - 630 Queen Elizabeth Way
P.O. Box 358
Iqaluit, Nunavut X0A 0H0
Telephone: (867) 979-8000

SAFETY DATA SHEET

Issuing Date : Revision Date : November 2020

1. IDENTIFICATION

GHS product identifier

Product Name : **Calcium Chloride 83-87% Flake**

Other means of identifications

Synonyms : Calcium Dichloride, Calcium Chloride, Calcium Chloride Flake. Briners grade.

BNQ Standard 2410-3000 / 2009 Certificate # 1161

Canadian Standard CAN-CGSB-15.1-92

Recommended use of the chemical and restrictions on use

Recommended Use For Diverse Applications: Concrete Acceleration, Ice Melting, Dust Control, Road Base stabilization

Uses advised against None identified

Supplier's details

Importer/Distributor :
SEL WARWICK INC.
807 boul. Pierre-Roux Est
Victoriaville, Qc Canada G6T 1T7
TEL : 819-758-5229

Manufacturer/Supplier :
Occidental Chemical Corporation
5005 LBJ Freeway – P.O. Box 809050
Dallas, TX. USA 75380-9050
Tel: 1-800-752-5151

Emergency telephone number

Emergency Telephone Number 819-758-5229

2. HAZARDS IDENTIFICATION

Classification

Acute Oral Toxicity	Category 4 – Harmful if swallowed
Serious Eye Damage/Eye Irritation	Category 2A – Causes serious eye irritation
Skin	Category 2 – Causes skin irritation

UNKNOWN ACUTE TOXICITY: A percentage of this product consists of ingredient(s) of unknown acute toxicity.

Unknown Acute Dermal Toxicity:

3% of this product consists of ingredient(s) of unknown acute dermal toxicity.

GHS Label elements, including precautionary statements

Emergency Overview

Signal Word: → **Warning**

Hazard Statements

-Causes serious eye irritation
-Causes skin irritation
-Harmful is swallowed

Appearance White **Physical State** Flake or pellet **Odor** Odorless

Precautionary Statements

Prevention

- Wear eye and face protection
- Wear protective gloves
- Wash thoroughly after handling
- Do not eat, drink or smoke when using this product

Eyes

- IF IN EYES : Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention

Skin

- IF ON SKIN: Wash with plenty of water. Take off contaminated clothing and wash it before reuse. If skin irritation occurs: Get medical advice/attention

Ingestion

- IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell, rinse mouth
- Specific treatment (see First Aid information on product label and/or Section 4 of the SDS)

Storage

- There are no Precautionary-Storage phrases assigned

Disposal

- Dispose of contents and container in accordance with applicable local, regional, national, and/or international regulations

Other Information

Mixing with water may cause heat to be release

See Section 11: Toxicological information

3. COMPOSITION / INFORMATION ON INGREDIENTS

Synonyms Calcium Dichloride, Calcium Chloride, Calcium Chloride Flake, Calcium Chloride Dihydrate. Briners grade, Food grade calcium chloride, Calcium Chloride 94%

Component	CAS-No	Percent %
Calcium Chloride	10043-52-4	> 83 - < 87
Water	7732-18-5	> 8 - < 14
Potassium Chloride	7447-40-7	> 2 - < 3
Sodium Chloride	7647-14-5	> 1 - < 2

NOTES: *Potassium chloride and sodium chloride are impurities from the naturally-occurring source material, brine solution.*

4. FIRST AID MEASURES

Description of necessary first-aid measures

Eye Contact — If in eyes, rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If irritation occurs, get medical advice/attention.

Skin contact — If on skin, wash with plenty of water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse. SPECIFIC TREATMENT: Wash with lots of water.

Inhalation — If inhalation of dust occurs and adverse effects result, remove to uncontaminated area. Call a POISON CENTER or doctor/physician if you feel unwell.

Ingestion — IF SWALLOWED : Rinse mouth. Call a POISON CENTER or doctor/physician if you feel unwell.

Protection for First-Aiders: At minimum, treating personnel should utilize PPE sufficient for prevention of bloodborne pathogen transmission. If potential for exposure exists refer to Section 8 for specific personal protective equipment.

Most important symptoms/effects, acute and delayed

Acute Symptoms/Effects: Listed below.
Inhalation (Breathing): Inhaling dust may cause irritation to upper respiratory tract (nose and throat). Nasal mucosal and oropharyngeal erythema.
Skin: Skin irritation**.** Direct abrasion of skin from solid, erythema and burn from reaction with water. Prolonged contact and occlusion may cause more severe symptoms. Damage is localized to contact areas.
Eye: Eye irritation. Direct abrasion of cornea from solid, erythema and burn from reaction with water, conjunctival swelling and cornea opacification from hypertonic solution and heat. Corneal eye pain, redness, acute corneal thickening or withening.
Ingestion (Swallowing): Consumption of solids or hypertonic solutions causes nausea, vomiting, and increased thirst.

Delayed Symptoms/Effects:
- Chronic exposure to skin and mucus membranes that cause irritation may cause a chronic dermatitis or mucosal membrane problem.

Interaction with Other Chemicals Which Enhance Toxicity: None known.

Medical Conditions Aggravated by Exposure: Any skin condition that disrupts the skin, such as abrasion, cuts, psoriasis, fungal infections, ect. Any upper respiratory conditions that compromise mucosa can increase local damage from dust contact. Any eye condition that compromises tear production, conjunctiva, or normal corneal homeostasis.

Notes to Physician: Due to irritant properties, resulting from heat created as solid material dissolves in water, swallowing may result in burns/ulceration of mucus membranes. If burn is present, treat as any thermal burn, after decontamination. No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. FIRE-FIGHTING MEASURES

Fire Hazard:
This material does not burn.

Suitable Extinguishing Media
Use extinguishing agents appropriate for surrounding fire.

Fire Fighting: Keep unnecessary people away, isolate hazard area and deny entry. This material does not burn. Fight fire for other material that is burning. Water should be applied in large quantities as fine spray. Wear NIOSH approved positive-pressure self-contained breathing apparatus operated in pressure demand mode. Wear protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). Avoid contact with this material during fire fighting operations. If contact is likely, change to full chemical resistant fire fighting clothing with self-contained breathing apparatus. If this is not available, wear full chemical resistant clothing with self-contained breathing apparatus and fight fire from a remote location. For protective equipment in post-fire or non-fire clean-up situations, refer to the relevant sections.

Hazardous Combustion Products: Formed under fire conditions: hydrogen chloride gas, calcium oxide.

Sensitivity to Mechanical Impact:	Not sensitive
Sensitivity to Static Discharge:	Not sensitive
Lower Flammability Level (air):	Not applicable
Upper Flammability Level (air):	Not applicable
Flash point:	Not applicable
Auto-ignition Temperature:	Not applicable

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions:
Isolate area. Keep unnecessary and unprotected personnel from entering the area. Spilled material may cause a slipping hazard on some surfaces. Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection. Refer to Section 7, Handling, for additional precautionary measure.

Methods and Materials for Containment and Cleaning Up:
Small and large spills: Contain spilled material if possible. Collect in suitable and properly containers. Flush residues with plenty of water. See Section 13, Disposal considerations, for additional information.

Environmental Precautions
Prevent large spills from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological information.

7. HANDLING AND STORAGE

Precautions for safe handling

Heat developed during diluting or dissolving is very high. Use cool water diluting of dissolving (temperature less than 27°C 80°F). Avoid contact with eyes, skin, and clothing. Do not swallow. Wash thoroughly after handling. See Section 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION.

Safe Storage Conditions	Store in a dry place. Protect from atmospheric moisture. Keep container tightly closed. Keep separated from incompatible substances (see below or Section 10 of the Safety Data Sheet).

Incompatible / Material to avoid Heat is generated when mixed with water or aqueous acids. Spattering and boiling can occur. Avoid contact with: bromide trifluoride, 2-furan percarboxylic acid because calcium chloride is incompatible with those substances. Contact with zinc forms flammable hydrogen gas, which can be explosive. Catalyzes exothermic polymerization of methyl vinyl ether. Attacks metals in the presence of moisture, and may release flammable hydrogen gas. Reaction of bromide impurity with oxidizing materials may generate trace of impurities such as bromates.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Regulatory Exposure Limit(s) : Listed below for the product components that have regulatory occupational exposure limits (OEL's) established.

Components	OSHA Final PEL TWA	OSHA Final PEL STEL	OSHA Final PEL Ceiling
Particles Not Otherwise Regulated (PNOR) 00-00-001	15 mg/ m^3 (Total) 5 mg/ m^3 (Respirable)	----	----

OEL: Occupational Exposure Limit; OSHA: United States Occupational Safety and Health Administration; PEL: Permissible Exposure Limit; TWA: Time Weighted Average; STEL: Short Term Exposure Limit

NON-REGULATORY EXPOSURE LIMIT(S): Listed below for the product components that have advisory (non-regulatory) occupational exposure limits (OEL's) established.
-The Non-regulatory Unites States Occupational Safety and Health Administration (OSHA) limits, if shown, are the Vacated 1989 PEL's (vacated by 58 FR 35338, June, 1993).

-The American Conference of Governmental Industrial Hygienists (ACGIH) is a voluntary organization of professionals industrial hygiene personnel in government of educational institutions in the United States. The ACGIH develops and publishes recommended occupational exposure limits each year called Threshold Limit Values (TLVs) for hundreds of chemicals, physical agents, and biological exposure indices.

Additional Advice:
1.Ingestion: Use good personal hygiene. Do not consume or store food in the work area. Wash hands before smoking or eating.

Engineering Controls Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guideline. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations. Local exhaust ventilation may be necessary for some operations.

Personal protective equipment

Eye/Face Protection Wear safety glasses with side-shields. For dust operations or when handling solutions of the material, wear chemical googles.

Skin and Body Protection Wear clean, body-covering clothing.

Hand protection: Use gloves chemically resistant to this material. If hands are cut or scratches, use gloves chemically resistant to this material even for brief exposure. Examples of preferred glove barrier materials include: Neoprene, Polyvinyl chloride("PVC" or "vinyl"), Nitrile/butadiene rubber ("nitrile" or "NBR"). NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials as well as the instructions/specifications provides by the glove supplier.

Respiratory Protection

Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. In dusty or misty atmosphere, use an approved particulate respirator. The following should be effective types of air-purifying respirators: High efficiency particulate air (HEPA) N95. A respiratory protection program that meets 29 CFR 1910.134 must be followed whenever workplace. Conditions warrant use of a respirator.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

- **Physical State** Flakes
- **Odor** Odorless
- **Appearance** White
- **Odor Threshold** No data available
- **Molecular Formula** $CaCl_2$

Property

- **pH** Not applicable to solids
- **Melting Point/Range** 772°C (1,422°F)
- **Boiling Point/Boiling Range** Not applicable to solids
- **Freezing Point/Range** Not applicable to solids
- **Evaporation Rate (ether=1)** No applicable
- **Vapor Pressure** Negligible at ambient temperature
- **Vapor Density** Not applicable
- **Relative Density/Specific Gravity (water=1)** Not applicable to solids
- **Bulk Density** 51 – 61 lb/ft3
- **Water Solubility** Readily soluble
- **Volatility** Not applicable
- **Partition coefficient (n-octanol/water)** No data available
- **Flash Point** Not applicable
- **Flammability (solid, gas)** Not applicable
- **Flammability Limits in Air**

Upper flammability limit Not applicable
Lower flammability limit Not applicable

- **Auto-ignition Temperature** Not applicable
- **Decomposition Temperature** Not applicable
- **Hygroscopic** Yes
- **Viscosity** Not applicable

10. STABILITY AND REACTIVITY

Reactivity
Hygroscopic. Liberates large amounts of heat when dissolving in water or aqueous acids.

Chemical Stability
Stable at normal temperature and pressures.

Possibility of hazardous reactions
Avoid moisture.

Hazardous Polymerization
Will not occur.

Conditions to avoid
(e.g., static discharge, shock, or vibration) -. None known.

Incompatible materials to avoid
Heat is generated when mixed with water or aqueous acids. Spattering and boiling can occur. Avoid contact with: bromide trifluoride, 2-furan percarboxylic acid because calcium chloride is incompatible with those substances. Contact with zinc forms flammable hydrogen gas, which can be explosive. Catalyzes exothermic polymerization of methyl vinyl ether. Attacks metals in the presence of moisture, and may release flammable hydrogen gas. Reaction of bormide impurity with oxidizing materials may generate trace of levels of impurities such as bromates.

Hazardous decompositions products
Formed under fire condition: hydrogen chloride gas, calcium oxide.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA:

COMPONENT TOXICITY DATA:
Note: The component toxicity date is populated by the LOLI database and may differ from the product toxicity data given.

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Calcium Chloride 10043-52-4	1000 mg/kg (Rat)	2630 mg/kg (Rat)	Not listed
Potassium Chloride 7447-40-7	Not listed	Not listed	Not listed
Sodium Chloride 7647-14-5	3000 mg/kg (Rat)	10 g/kg (Rabbit)	42 g/m^3 (Rat) 1h

POTENTIAL HEALTH EFFECTS:

Eye contact : For solid : May cause slight eye irritation, mechanical injury only. Dust formation should be avoided, as dust can cause severe eye irritation with corneal injury

Skin contact : Brief contact is essentially non-irritating to skin. Prolonged contact may cause skin irritation, even a burn. Not classified as corrosive to the skin according to DOT guidelines. May cause more severe response if skin is damp, abraded (scratched or cut), or covered by clothing, gloves, or footwear.

Inhalation : Dust may cause irritation to upper respiratory tract (nose and throat).

Ingestion : Low toxicity if swallowed. Small amounts swallowed incidentally as a result of normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause local mucosal damage to esophagus and stomach. Swallowing may result in gastrointestinal irritation or ulceration.

Chronic Effects: Chronic exposures to calcium chloride that cause irritation may cause a chronic dermatitis or mucosal membrane problem. For the minor component(s): POTASSIUM CHLORIDE: In animals, effects have been reported on the following organs after ingestion: Gastrointestinal tract, heart, and kidney. Dose levels producing these effects were many times higher than any dose levels expected from exposure due to use. SODIUM CHLORIDE: Medical experience with sodium chloride has shown a strong association between elevated blood pressure and prolonged dietary overuse. Related effects could occur in the kidneys.

SIGNS AND SYMPTOMS OF EXPOSURE:
Solution and/or solids may be visible on the skin and/or eyes. Localized redness, warmth, and irritation consistent with mechanism of injury: abrasion, burn, hypertonic solution.

Inhalation (Breathing) : Inhaling dust may cause irritation to upper respiratory tract (nose and throat). Nasal mucosal and oropharyngeal erythema.
Skin : Skin Irritation. Direct abrasion of skin from solid, erythema and burn from reaction with water. Prolonged contact and occlusion may cause more severe symptoms. Damage is localized to contact areas.
Eye : Eye Irritation. Direct abrasion of cornea from solid, erythema and burn from reaction with water, conjunctival swelling and cornea opacification from hypertonic solution and heat. Corneal eye pain, redness, acute corneal thickening or whitening.
Ingestion (Swallowing) : Consumption of solids or hypertonic solutions causes nausea, vomiting, and increased thirst.

Interaction with Other Chemicals Which Enhance Toxicity : None known

GHS HEALTH HAZARDS:

GHS: ACUTE TOXICITY – ORAL Category 4 – Harmful swallowed

GHS: CONTACT HAZARD – EYE Category 2A – Causes serious eye irritation

GHS: CONTACT HAZARD – SKIN Category 2 – causes skin irritation

Skin Absorbent / Dermal Route? No

MUTAGENIC DATA:
Not classified as a mutagen per GHS criteria. The data presented are for the following material: Calcium chloride ($CaCl_2$) – In vitro genetic toxicity studies were negative. The data presented are for the following material: Potassium chloride – In vitro genetic studies were positive. However, the relevance of this to humans in unknown. For the minor component(s): Sodium chloride – In vitro genetic toxicity studies were predominantly negative.

DEVELOPMENTAL TOXICITY:
Not classified as a development or reproductive toxin per GHS criteria. For the major component(s): Did not cause birth defects or any other fetal effects in laboratory animals.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:

Component	Freshwater Fish:	Invertebrate Toxicity:	Algae Toxicity:	Other Toxicity:
Calcium Chloride	-LC50, bluegill (Lepomis macrochirus): 8350 – 10650 mg/l	-LC50, water flea Daphnia magna: 759 – 3005 mg/l	-No data available	-No data available
Potassium Chloride	-LC50, raimbow trout (Oncorhynchus mykiss), 96 h: 4,236 mg/l	-EC50, water flea Daphnia magna, 24 h, immobilization: 590 mg/l -LC50, water flea Ceriodaphnia dubia, 96 h: 3,470 mg/l	-No data available	-No data available
Sodium Chloride	-LC50, fathead minnow (Pimephales promelas): 10,610 mg/l	-LC50, water flea Daphnia magna: 4,571 mg/l	-IC50, OECD 209 Test; activated sludge, respiration inhibition: > 1,000 mg/l	-IC50, OECD 209 Test; activated sludge, respiration inhibition: > 1,000 mg/l

Aquatic Toxicity:
Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 > 100 mg/l in the most sensitive species tested)

Invertebrate Toxicity:
Calcium ChlorideL LC50, water flea Daphnia magna: 759 – 3,005 mg/l
Potasium Chloride: EC50, water flea Daphnia magna, 24 h, immobilization: 590 mg/l
LC50, water flea Ceriodaphnia dubia, 96 h: 3,470 mg/l
Sodium Chloride: LC50, water flea Daphnia magna: 4,571 mg/l

FATE AND TRANSPORT:

BIODEGRADATION: This material is inorganic and not subject to biodegradation.

PERSISTENCE: Calcium chloride is believed not to persist in the environment because it is readily dissociated into calcium and chloride ions in water. Calcium chloride released into the environment is thus likely to be distributed into water in the form of calcium and chloride ions. Calcium ions may remain in soil by binding to soil particulate or by forming stable salts with other ions. Chloride ions are mobile and eventually drain into surface water. Both ions originally exist in nature, and their concentrations in surface water will depend on various factors, such as geological parameters, weathering, and human activities.

BIOCONCENTRATION: No bioconcentration is expected because of the relatively high water solubility. Potential for mobility in soil is very high (Koc between 0 and 50). Partitioning from water to n-octanol is not applicable.

BIOACCUMULATIVE POTENTIAL: Calcium chloride and its dissociated forms (calcium and chloride ions) are ubiquitous in the environment. Calcium and chloride ions can also be found as constituents in organisms. Considering its dissociation properties, calcium chloride is not expected to accumulate in living organisms.

MOBILITY IN SOIL: Calcium chloride is not expected to be absorbed in soil due to its dissociation properties and high water solubility. It is expected to dissociate into calcium and chloride free ions or it may form stable inorganic or organic salts with other counter ions, leading to different fates between calcium and chloride ions in soil and water components. Calcium ions may bind to soil particulate or may form stable inorganic salts with sulfate and carbonate ions. The chloride ion is mobile in soil and eventually drains into surface water because it is readily dissolved in water.

13. DISPOSAL CONSIDERATIONS

Waste from material	Reuse or reprocess, if possible. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Report spills if applicable. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. AS YOUR SUPPLIER, WE HAVE NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN SDS SECTION. Composition Information. FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: Landfill and waste water treatment system.
Container Management	Dispose of container in accordance with the applicable local, regional, national, and/or international regulations. Container rinsate must be disposed of in compliance with applicable regulations.

14. TRANSPORT INFORMATION

LAND TRANSPORT

U.S. DOT 49 CFR 172.101:
Status: Not Regulated
CANADIAN TRANSPORTATION OF DANGEROUS GOODS:
Status: Not Regulated

MARITIME TRANSPORT (IMO / IMDG) Not Regulated
Status – IMO / IMDG: Not Regulated

15. REGULATORY INFORMATION

U.S REGULATIONS

OSHA REGULATORY STATUS:
This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200)

CERCLA SECTIONS 102a/103 HARZARDOUS SUBSTANCES (40 CFR 302.4) :
Not regulated**.**

SARA EHS Chemical (40CFR 355.30) :
Not regulated**.**

EPCRA SECTIONS 311/312 HAZARD CATEGORIES (40 CFR 370.10) :
Acute Health Hazard

EPCRA SECTION 313 (40 CFR 372.65) :
To the best of our knowledge, this product does not contain chemical at levels which require reporting under this statute.

OSHA PROCESS SAFETY (PSM) (29 CFR 1910.119) :
Not regulated**.**

NATIONAL INVENTORY STATUS

U.S. INVENTORY STATUS : Toxic Substance Control Act (TSCA) : All components are listed exempt.

TSCA 12(b): This product is not subject to export notification.

Canadian Chemical Inventory: All components of this product are listed on either the DSL or the NDSL.

Component	DSL	NDSL
Calcium chloride 10043-52-4	Listed	Not Listed
Potassium Chloride 7447-40-7	Listed	Not Listed
Sodium Chloride 7647-14-5	Listed	Not Listed

STATE REGULATION

California Proposition 65:
This product is not listed, but it may contain impurities/trace element known to the State of California to cause cancer or reproductive toxicity as listed under Proposition 65 State Drinking Water and Toxic Enforcement Act.
WARNING: This product (when used in aqueous formulations with a chemical oxidizer such as ozone) mat react to form calcium bromate, a chemical known to the State of California to cause cancer.

Component	California Proposition 65 Cancer WARNING:	California Proposition 65 CRT List – Male reproductive toxin:	California Proposition 65 CRT List – Female reproductive toxin:	Massachusetts Righ to Know Hazardous Substance list	New Jersey Right to Know Hazardous Substance List	New Jersey Special Health Hazards Substance List
Calcium chloride 10043-52-4	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
Potassium Chloride 7447-40-7	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
Sodium Chloride 7647-14-5	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed

Component	New Jersey Environmental Hazardous Substance List	Pennsylvania Right To Know Hazardous Substance List	Pennsylvania Right To Know Special Hazardous Substances	Pennsylvania Right To Know Environmental Hazard list	Rhode Island Right To Know Hazardous Substance List
Calcium Chl. 10043-52-4	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
Potassium Chl. 7447-40-7	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
Sodium Chl. 7647-14-5	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed

CANADIAN REGULATIONS

- This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products regulations.

Component	Canadian Chemical Inventory:	NDSL:	WHMIS – Classifications Of Substances:
Calcium Chloride	Listed		D2B
Potassium Chloride	Listed		Uncontrolled product according to WHMIS classification criteria
Sodium Chloride	Listed		Uncontrolled product according to WHMIS classification criteria

16. OTHER INFORMATION

Prepared By Sel Warwick Inc
807 boul. Pierre-Roux Est
Victoriaville, Qc G6T 1T7
819-758-5229

Issuing Date November 2020
Revision Date
Revision Note

General Disclaimer

The information provided on this SDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of Safety Data Sheet

Dust Stop Municipal Blend

SECTION 1: IDENTIFICATION

Product Name:	Dust Stop Municipal Blend
Synonyms:	DSMB
CAS Number:	See Section 3
Product Use:	A water-based nonhazardous, environmentally friendly and biodegradable liquid used for dust control on roads
Manufacturer/Supplier:	Cypher Environmental Ltd.
General Information:	WHMIS Classification: Not Controlled
Address:	Cypher Environmental Ltd. 1149 St. Matthews Ave. Winnipeg Manitoba R3G 0J8 Canada
Emergency Number:	Tel: (204)-489-1214 Fax: (204)489-7372

Section 2: HAZARD IDENTIFICATION

Health Environmental Physical:	Biodegradable
Acute Toxicity:	Non- Toxic, pathogen free.
Skin/Eye Corrosion:	Contact with skin may result in mild irritation.
Mutagenicity/ Carcinogenicity/Devel opmental:	Non-mutagenic and non-carcinogenic Based on available information, none of the ingredients in Dust Stop Municipal Blend are regulated nor listed as potential cancer agents by Federal OSHA, NTP or IARC.
Reproductive/Develop mental:	Not Determined
Target Organ Toxicity (Repeated):	Not Determined
Toxicity:	Non-Toxic, pathogen free

GHS Label:

Signal Word: DANGER!

Hazard Statements:

WHMIS HAZARD RATING INFORMATION	FLAMMABILITY	HEALTH	REACTIVITY
0-Minimal 1-Slight 2-Moderate 3-Serious 4-Severe	0	1	0

Section 3: COMPOSITION / INFORMATION ON INGREDIENTS

Unique Identifiers

INGREDIENTS (Complex mixture)	% by weight	CAS NO.
Water	5-10	-
Proprietary Anionic Polyelectrolyte Additive	Proprietary	CAS Listed
Proprietary Additive	Proprietary	CAS Listed
Reduced Sugars	Proprietary	CAS Listed
Silicates and Carbonates	Proprietary	Mixture

* Based on available information, none of the ingredients in Dust Stop Municipal Blend are regulated nor listed as potential cancer agents/hazardous by Federal OSHA, NTP or IARC.

Section 4: FIRST AID MEASURES

Eye: A slight eye irritant.

Skin: Contact with skin may result in mild irritation, rinse with plenty of water.

Inhalation and Ingestion: Considered non-harmful by all exposure routs , if breathing is difficult remove to fresh air.

Signs and Symptoms of Exposure: None. Ingestion may cause mild nausea or diarrhea.

Section 5: FIRE FIGHTING MEASURES

Suitable Extinguisher Media:	Treat the same as water
Fire Fighting Procedures:	Isolate fire area and deny unnecessary entry, Soak thoroughly with water to cool and prevent re ignition. Cool surroundings with water to localize fire zone. Hand held carbon dioxide or dry chemical hazard may result from forceful application of fire extinguishing agents. Do not enter fire area with out protective equipment.

Section 6: ACCIDENTAL RELEASE MEASURES

PPE:	Eye: Safety goggles Respirator: Not applicable Clothing: Regular on-Site clothing
Emergency Procedures:	In case of accidental spill or discharge, take up and containerize for disposal according to state and local regulations. This product displays ultimate biodegradability under both aerobic and anaerobic conditions and if spilled should not cause any adverse short or long term environmental impacts. Ventilation requirements as normal
Methods and Materials For Containment and Cleaning Up:	For smaller spills, Wash contaminated area with water and flush into sewage system or any other disposal system. For large spills, soak up with sand or sweeping compound and dispose at solid waste

Section 7: HANDLING AND STORAGE

Handling: **Keep container closed when not in use. If container is being stored for extended periods, provide minimal to moderate agitation every few weeks ensuring re-homogenization of product.**

Storage:

Storage Temperature (Degrees C/F)
Minimum: 10°C (50°F)
Maximum: 20-25°C (68-77°F)
Application Temperature:
Minimum: 10°C (50°F)
Maximum: 57°C (135°F)
Optimum Working Temperature Range:
18-45°C (64-113°F)
*Store product in an area that is not exposed to direct sunlight and in an environment within the conditions stated above.

Section 8: EXPOSURE TO CONTROLS AND PERSONAL PROTECTION

OSHA PEL's:	Not Applicable
Exposure Limits:	Dust Stop Municipal Blend presents no health hazards to the user, other than mild eye and skin irritancy.

Engineering Controls:

	No specific engineering controls needed, it is recommended to handle concentrated product in a well ventilated area
PPE:	
Eye Protection:	Safety goggles, avoid eye contact or exposure to concentrated amounts of product
Skin Protection:	Regular on-Site clothing , rinse from skin when exposed to product
Respiratory Protection:	Respirator: Not applicable, ventilation as normal

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Flashpoint:	Not flammable; not combustible
Auto Ignition:	None
Boiling Point:	>100°C
Melting Point:	Liquid
Freezing Point:	<0°C
Vapor Pressure:	Not Determined
Miscibility with water:	Miscible in all proportions
Solubility in Water:	Soluble
Lower and Upper Flammability Limits:	Not flammable
Specific Gravity:	1.24 @ 25 °
Density:	1.4 g/cm^2 @ 25 °
pH:	9.19
Ultimate Biodegradability:	DOC reduction >90% after 28 days
Appearance:	Brown slightly viscous liquid
Odor:	Sweet organic odor
Composition:	A blend of carbohydrates, water-soluble polymers, and solid mineral.

Section 10: STABILITY AND REACTIVITY

Stability/ Incompatibility:	Stable for a minimum of two years when stored in proper conditions (see above section 7)
Hazardous Reactions/Decomposition Products	Not determined
Reactivity:	Not determined
Chemical Stability:	Stable
Conditions To Avoid:	Storage above 50°C (120°F) or below 0°C (32°F). Avoid contact with strong oxidizing and reducing agents.
Incompatible Materials:	None
Hazardous Decomposition Products:	Not determined, None

Section 11: TOXILOGICAL INFORMATION

Signs, Symptoms of Over Exposure and First Aid Treatment:

Eye Contact: Reddening may develop. Immediately rinse the eye with large quantities of cool water. Continue 10-15 minutes or until material has been removed. Be sure to remove contact lenses, if present, and lift upper and lower lids during rinsing. Get medical attention if irritation persists.

Skin Contact: Minimal effects, if any. Rinse skin with water. Rinse shoes and launder clothing before reuse.

Swallowing: Essentially non-toxic. Product may cause a slight laxative condition. Give several glasses of water to dilute if swallowed. Do not induce vomiting. If stomach upset persists, consult a physician.

Inhalation: Non-toxic. Prolonged exposure to product in a mist form (not recommended) could cause a mild irritation of the nasal passages and throat. Remove to get fresh air. Get medical attention if irritation persists.

Section 12: ECOLOGICAL INFORMATION

Bio Accumulative Potential:	The product exhibits ultimate biodegradability under anaerobic conditions as defined by US EPA methods (40 CFR part 796.3180).

Section 13: DISPOSAL CONSIDERATIONS

See section 6

Section 14: TRANSPORTATION INFORMATION

This product is non-toxic, transport in conditions described in section 7 above.
INTERNATIONAL AIR TRANSPORTATION ASSOCIATION: this product is not regulated by IATA, when shipped internationally.

Section 15: REGULATORY INFORMATION

SARA/TITLE III – CERCLA List of Hazardous Substances and Reportable Quantities (40 CFR 304.4): This product **does not** contain an ingredient(s) listed as a hazardous ingredient for Emergency Release Notification under section 304.

SARA/TITLE III – List of Extremely Hazardous Substances for Emergency Planning and Notification (40 CFR 300 & 305): This product **does not** contain an ingredient(s) listed as an extremely hazardous substance (EHS) for Emergency Planning under sections 301-303 and for Emergency Release Notification under section 304.
SARA/TITLE III – List of Toxic Chemical subject to Release Reporting (Community Right to Know) (40 CFR 372): This product **does not** contain an ingredient(s) listed as a toxic chemical for Annual Release Reporting Requirements under section 313.

Section 16: OTHER INFORMATION

Date of SDS Preparation:	August 2016
Original or Revised Copy:	Last Updated August 2016 **Reasonable care has been taken to ensure information and advice contained in this data sheet is accurate at the time of printing. However, Cypher Environmental Ltd. Accepts no liability for any loss or damages suffered as a consequence of reliance on the information contained herein.**
Changes Made to Original SDS:	
Disclaimers:	Please contact the supplier for application instructions, the application rate/procedure may fluctuate depending on specific uses of product and applications.

The above information pertains to this product as currently formulated, and is based on the information available at this time. Addition of reducers or other additives to this product may substantially alter the composition and hazards of the product. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information.

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EK35® SERIES

SAFETY DATA SHEET

SECTION I -- IDENTIFICATION OF SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

TRADE NAME: EK35® Synthetic Organic Dust Control® (Series of Products)
advanced environmental performance solution

MANUFACTURER: Midwest Industrial Supply, Inc
1101 3rd Street SE
Canton, OH 44707

EMERGENCY PHONE NUMBER: 330-456-3121

RECOMMENDED USE: Dust Suppressant; Stabilizing Agent

CHEMICAL NAME: Isoalkane and binder system

SYNONYMS: Dust retardant and stabilization agent

SECTION II -- HAZARDS IDENTIFICATION

CLASSIFICATION: Eye Irritant, 2B

SIGNAL WORD: Warning

HAZARD STATEMENT(S): Causes eye irritation

Pictograms

PRECAUTIONARY STATEMENT(S): Flush eyes for several minutes.
Wash hands and exposed areas thoroughly.
Contact physician if irritation persists.

OTHER HAZARDS: None

SECTION III -- COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS #	WT %
Severly hydrotreated, high viscosity, synthetic iso-alkane	72623-86-0	> 10%
Tall-oil pitch	8016-81-7	< 60%
Alkyl polyamines	Proprietary	< 4%

SECTION IV -- FIRST AID MEASURES

INHALATION: Move subject to fresh air. If victim is not breathing, perform artificial respiration. Administer oxygen if available. Keep victim warm and at rest. Seek medical attention as soon as possible.

SKIN: Flush with large amount of water or wash with soap and water. Seek medical attention as soon as possible.

EYES: Flush eyes with flowing water at least 15 minutes. Get medical attention. Do not use any eye ointment.

Revision Date : 5/21/2015

Remove contact lenses.

INGESTION: EK35 has a laxative effect and will be elminated quickly. Seek medical attention. NEVER GIVE FLUIDS OR INDUCE VOMITING IF PATIENT IS UNCONSCIOUS OR HAVING CONVULSIONS.

RECOMMENDATION TO FIREFIGHTERS ON SPECIAL PROTECTIVE EQUIPMENT OR PRECAUTIONS:

Respiratory and eye protection are required for fierfighting personnel. Self-containted breathing apparatus (SCBA) are required for condtions.

SECTION V -- FIREFIGHTING MEASURES

EXTINGUISHING MEDIUM: As this material is virtually not-flammable, use proper equipment to fight surrounding fire.

SPECIAL FIREFIGHTING PROCEDURES: If a tank, railcar of tank truck is involved in a fire isolate for 0.5 miles in all directions. Shut off fuel to fire if it is possible to do so without hazard. If this is impossible, withdraw from the area and let the fire burn itself out under controlled conditions. Withdraw immediately in case of rising sound from venting safety device or any discoloration of the tank due to fire. Cool containing vessels with water spray in order to prevent pressure build-up, autoignition or explosion.

UNUSUAL FIRE AND EXPLOSION HAZARDS: None

SPECIAL HAZARDS: Do not cut, weld, heat, drill, or pressureize empty container.

SECTION VI -- ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS: Safety glasses, gloves, and protective clothing

SPILL AND LEAK PROCEDURES: ELIMINATE ALL IGNITION SOURCES. Stop leak without risk and contain spill. Absorb with inert absorbent materials such as clay or sand. Place absorbent in closed metal containers for later disposal or burn in appropriate facility. Keep spills out of sewers and open bodies of water.

SECTION VII -- HANDLING AND STORAGE

STORAGE: Keep in cool, dry, ventilated storage area and in closed containers. Keep away from sources of ignition and oxidizing materials.

HANDLING: KEEP AWAY FROM SOURCES OF IGNITION. Do not reuse empty containers. Practice good hygiene. Wash hands before eating. Launder clothes before reuse. Discard saturated leather goods.

SECTION VIII -- EXPOSURE CONTROL/PERSONAL PROTECTION

OSHA PEL (8 hour TWA): 5 mg/m^3 for synthetic product mists.

VENTILATION:	Under normal handling conditions special ventilation is not necessary. If operation generates mist or fumes, use ventilation of keep exposure to airborne contaminants below exposure limits.
RESPIRATORY PROTECTION:	None required if good ventilation is maintained. If mist is generated by heating or spraying, use a NIOSH approved organic respirator with a mist filter.
EYE PROTECTION:	Chemical splash, goggles recommended.
PROTECTIVE CLOTHING:	Clothing to minimize skin contact, long sleeves, boots or shoes. For casual contact PVC gloves are suitable, for prolonged contact use neoprene or nitrile gloves.

SECTION IX -- PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Odor:	Woody, musty odor
Vapor Density:	N/D
Solubility in Water:	Insoluble
Relative Density:	0.85-1.00 g/mL
Melting/Freezing Point:	N/D
VOC Content:	N/D
Viscosity:	150-250 cSt @ 22°C
Flashpoint:	>140°C (>284°F)
Flammable Limits LEL:	N/D
Flammable Limits UEL:	N/D
Odor Threshold:	N/D
Initial Boiling Point/Range:	>316°C (>601°F)
Vapor Pressure:	Negligible at ambient temperature
Evaporation Rate:	N/D
pH:	N/A, not an aqueous solution or emulsion
Octanol/Water Coefficient:	N/D
Decomposition Temperature:	N/D
Flammability (solid/gas):	N/A
Auto Ignition Temperature:	>235°C (>455°F)

SECTION X -- STABILITY AND REACTIVITY

REACTIVITY:	None
CHEMICAL STABILITY:	Stable
CHEMICAL INCOMPATIBILITY:	Can react with strong organic oxidizing materials
HAZARDOUS DECOMPOSITION PRODUCTS:	Thermal decomposition in the presence of air may yield carbon monoxide and/or carbon dioxide, smoke, hydrocarbons and irritating

fumes.

HAZARDOUS POLYMERIZATION: Does not occur under normal industrial conditions.

CONDITIONS TO AVOID: Excessive heat and flame

SECTION XI -- TOXICOLOGICAL INFORMATION

EFFECTS OF OVEREXPOSURE

INHALATION: Inhalation is highly unlikely, however, prolonged or repeated inhalation of fumes or mists may cause irritation to the respiratory tract. Product deposits in lungs may lead to fibrosis and reduced pulmonary function.

SKIN: It is not a skin irritant, however, prolonged or repeated contact may cause skin irritation, dermatitis, or oil acne.

EYES: Prolonged or repeated contact may be irritating to eyes. Will not cause permanent damage.

INGESTION: Relatively non-toxic to digestive tract.

CARCINOGENICITY: Based on studies to date EK35® is not known to be carcinogenic to humans.
ACGIH (mists) - Based on available human studies, exposure to product mist alone has not demonstrated to cause human effects at levels below 5 mg/m3.
IARC - IARC group 3; cannot be classified as to carcinogenicity to humans.
NTP - No studies were found.
IRIS - No studies were found.
OSHA - OSHA PEL (8 hour TWA) = 5 mg/m3 for synthetic product mists.

GERM CELL MUTAGENICITY: N/D

REPRODUCTIVE TOXIN: Based on data to date, it does not pose a reproductive risk.

SECTION XII -- ECOLOGICAL INFORMATION

EK35® Aquatic Toxicity Test Results

*Methods for Measuring the Acute Toxicity of Effluents and Receiving Water to Freshwater and Marine Organisms, EPA/600/4-90/027F.
*Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms, EPA/600/4-91/002.
*Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Marine and Estuarine Organisms, EPA/600/4-91/003.

	Ceriodaphnia dubia	Fathead minnow	Americamysis bahia	Rainbow Trout
Acute/Survival (mg/L)				
LC50	>1000	271	111	30

NOEC	1000	125	63	--
LOEC	>1000	250	130	--
Chronic/Survival (mg/L)				
LC50	>1000	97.3	58.6	23
NOEC	500	31.3	25	10
LOEC	1000	62.5	50	20
Chronic/Growth/Reproduction (mg/L)				
LC50	375	114	>50	>10
NOEC	250	31.3	50	10
LOEC	500	62.5	>50	>10

See attached test results:
1. ABC Laboratories, Inc. Americamysis bahia, Fathead minnow, Ceriodaphnia dubia.
2. ABC Laboratories, Inc. Rainbow trout

LC50 - Lethal Concentration, 50%
NOEC - No Observable Effects Concentration
LOEC - Lowest Observable Effects Concentration

The LC50 level is the lethal concentration of the chemical under test that kills 50% of the test organisms in the specified amount of time. According to the EPA-540-9-85-006, suggested toxicity criteria for materials are listed in the table below. Comparison of the EPA guidelines to the LC50 of EK35® show a range of toxicity from practically non-toxic to moderately toxic depending on the species and the exposure time. When used and applied properly EK35® is not known to pose any ecological problems.

SECTION XIII -- DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Consult your local authorities for regulations. Preferred waste management: recycle or reuse, incinerate with energy recovery, disposal in a licensed facility. Disposal facility should be compliant with state, local and federal government regulations.

SECTION XIV -- TRANSPORTATION INFORMATION

DOT HAZARDOUS MATERIAL DESCRIPTION: Non-regulated
PROPER SHIPPING NAME: EK35®
UN NUMBER: N/D
HAZARD CLASS/PACKAGING GROUP: Non-regulated

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EK35® SERIES

SAFETY DATA SHEET

LABELS REQUIRED: None

SECTION XV -- REGULATORY INFORMATION

NFPA RATING:	Health:	1	**HMIS RATING:**	Health:	1
	Flammability:	1		Flammability:	1
	Instability:	0		Physical Hazard:	0
				PPE:	B

EPA SARA Title III hazard class: None
OSHA HCS hazard class: eye irritant
EPA SARA Title III Section 313 (40CFR372)
Toxic Chemicals present in quantities greater than the "de minimus" level are: None
TSCA: Components of this product are listed on TSCA inventory
Canadian WHIMIS: This product is not a "controlled product" under the Canadian Workplace Hazardous Material Information System.
Canadian DSL: All components of this product are listed on Domestic Substance List.
California Proposition 65: Does not contain any Prop 65 chemicals.

SECTION XVI -- OTHER INFORMATION

LATEST REVISION: 22-May-15
ABBREVIATIONS AND SYMBOLS:

N.D.	Not Determined	N.A.	Not Applicable	N.T.	Not Tested
<	Less Than	>	More Than		